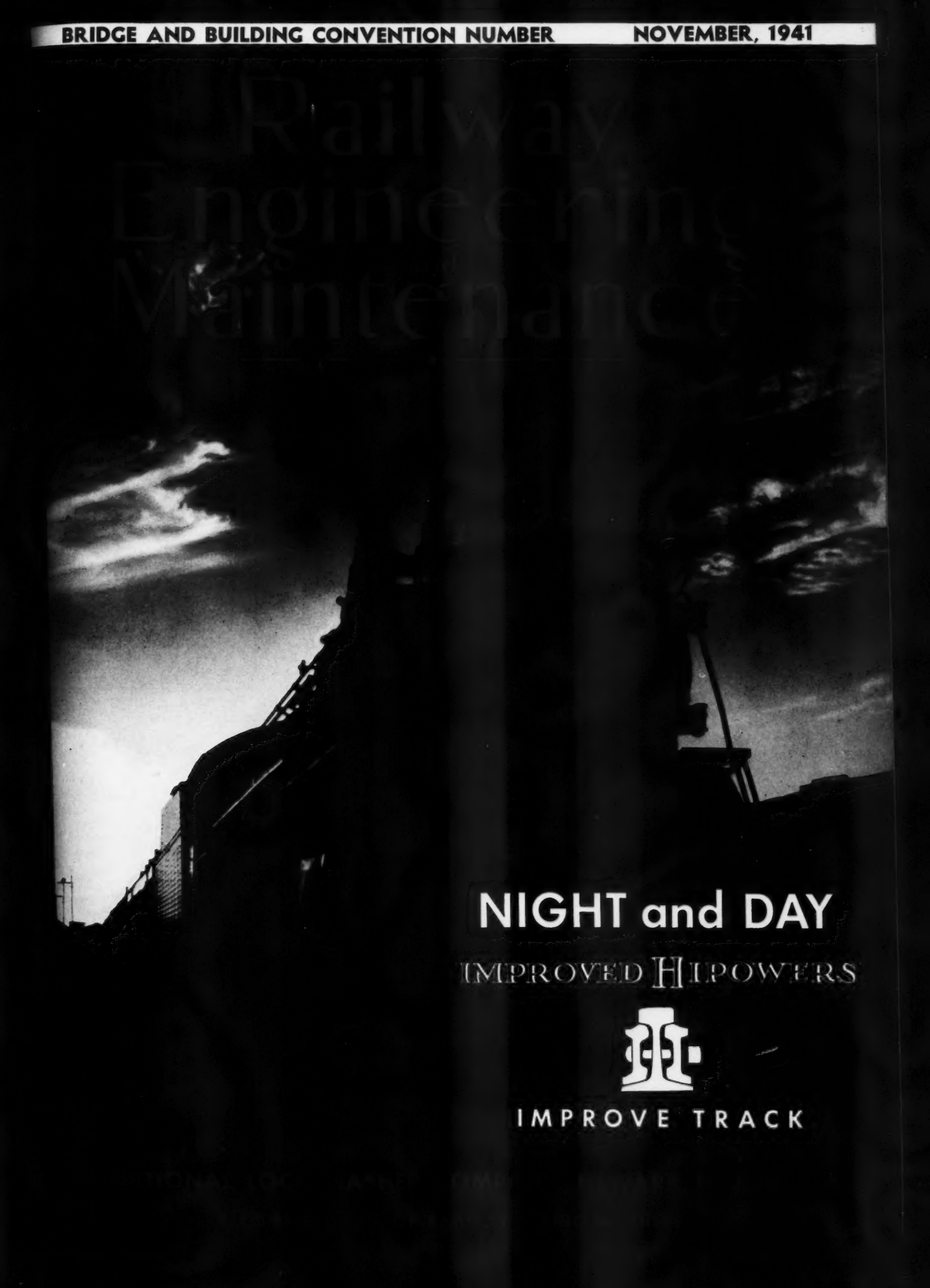
BRIDGE AND BUILDING CONVENTION NUMBER NOVEMBER, 1941

Railway Engineering Maintenance



NIGHT and DAY

IMPROVED HIPOWERS

IMPROVE TRACK

Reliance HY-CROME *Spring Washers*

TODAY'S HEAVY RAIL TRAFFIC MOVEMENT DEMANDS THE MAXIMUM IN SERVICE FROM TRACK AND ROLLING EQUIPMENT. **YOUR** INVESTIGATION OF THE SUPERIOR AND EXCLUSIVE FEATURES EMBODIED IN *Hy-Crome Pressure Springs* FOR TRACK AND *Locomotive Hy-Crome Spring Washers* FOR ENGINES WILL PAY EXTRA DIVIDENDS IN EFFICIENCY AND ECONOMY AND HELP MEET PREVAILING CONDITIONS MORE SUCCESSFULLY.

A FEW MOMENTS OF YOUR TIME FOR SERIOUS CONSIDERATION OF OUR CLAIMS IS ALL WE REQUEST

Eaton Manufacturing Company

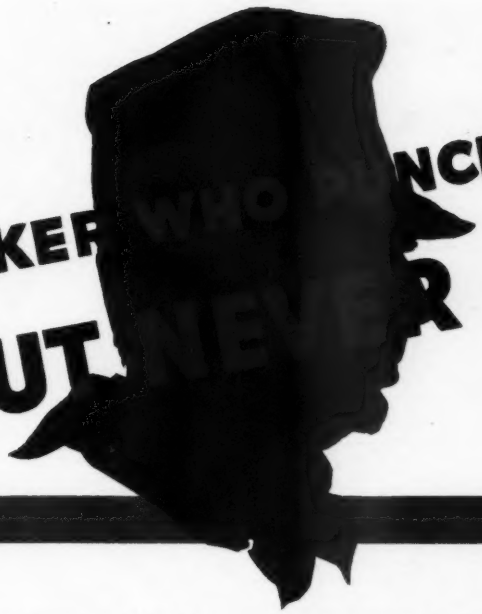
RELIANCE SPRING WASHER DIVISION

MASSILLON, OHIO

New York • Cleveland • Detroit • Chicago • St. Louis • San Francisco • Montreal

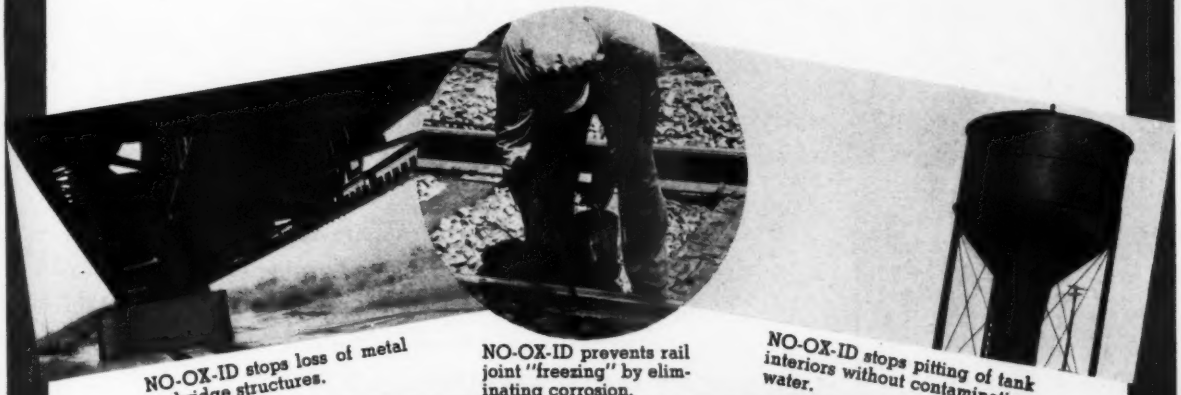
Published monthly by Simmons-Boardman Publishing Corporation, 105 W. Adams St., Chicago, Ill. Subscription price: United States and Possessions, and Canada, $2.00; Foreign, $3.00. Single copies 35 cents. Entered as second-class matter January 20, 1933, at the post office at Chicago, Ill., under the act of March 3, 1879, with additional entry at Mount Morris, Ill., postoffice. Address communications to 105 W. Adams St., Chicago, Ill.

A WORKER WHO [illegible]NCHES IN — BUT NEVER [illegible]R OUT



RUST . . . the tireless, undesirable . . . comes to stay and continue destructive work unless you take aggressive protective steps. NO-OX-ID, the original rust preventive, provides that protection in two ways: (1) *MECHANICALLY* by excluding moisture and oxygen and (2) *CHEMICALLY* by inhibiting underfilm corrosion. When applied on clean metal NO-OX-ID forms a protective film that lasts indefinitely. But of greater importance, NO-OX-ID can be applied to rusted iron or steel *without expensive cleaning.* Loosens rust scale which falls off, then a touching up of bare spots provides long, lasting protection. Write for data booklet.

STOP THE RAVAGES OF RUST WITHOUT EXPENSIVE CLEANING!



NO-OX-ID stops loss of metal on bridge structures.

NO-OX-ID prevents rail joint "freezing" by eliminating corrosion.

NO-OX-ID stops pitting of tank interiors without contaminating water.

NO-OX-ID
IRON + OX = RUST
TRADE MARK
The Original Rust Preventive

DEARBORN CHEMICAL COMPANY, DEPT. U, 310 SOUTH MICHIGAN AVE., CHICAGO, ILL.

AS DEPENDABLE AS THE LIMITED . . .

and Equipped with the same bearings – **TIMKEN**

TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
TAPERED ROLLER BEARINGS

Journal bearings are as important in section motor cars and trailers as they are in modern locomotives, cars and streamlined trains. Maintenance equipment needs their smoothness, strength and endurance as much as the main line speedsters. That's mainly why most leading makes are Timken Bearing Equipped.

Another reason is lower upkeep cost—less time required for lubrication and general bearing attention.

When you buy new section motor cars or trailers make sure they have Timken Tapered Roller Bearings on the axles.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

Manufacturers of Timken Tapered Roller Bearings for automobiles, motor trucks, railroad cars and locomotives and all kinds of industrial machinery; Timken Alloy Steels and Carbon and Alloy Seamless Tubing; and Timken Rock Bits.

1. CEMENT DISPERSION

This important technologic achievement raises all existing concrete standards and makes important savings. It now assures —

A—Concrete of given strength at lower cost

B—Stronger and more durable concrete at a given cost

Only a part of the cementitious value of the cement, whether normal portland or high early, is utilized under usual construction conditions. Investigation shows that with 28 days curing only 50% of the cement hydrates. Even with 90 days curing only 60% of the cement hydrates. [Anderegg and Hubbell, A.S.T.M. 29 II 554 (1929)].

The addition of POZZOLITH, containing a cement dispersing agent, to concrete mixes increases the degree of hydration of the cement at 28 days to approximately 71%. Today Pozzolith is being widely used to lower initial costs, to increase speed of job, and to secure better concrete.

2. EMBECO GROUTING

Embeco, a specially prepared metallic aggregate, when mixed with sand, cement and water makes lasting grouts and concrete repairs. Embeco expands sufficiently to compensate for the natural shrinkage of cement mortars thus assuring perfect contact with bedplate, absence of vibration, and exclusion of oil and water.

In the restoration of disintegrated concrete structures Embeco is being used successfully. Many concrete structures are being restored through the use of Embeco which makes the concrete patching a permanent part of the structure.

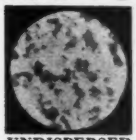
SAVE MONEY—SPEED UP

Get the facts on Pozzolith and Embeco, how they save money and speed up the job. Ask for the complete story.

THE MASTER BUILDERS COMPANY

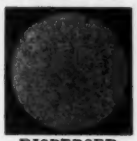
CLEVELAND, OHIO **TORONTO, CANADA**

HOW POZZOLITH WORKS



UNDISPERSED

Pozzolith contains Master Builders' cement dispersing agent. Cement particles in their normal state in water tend to gather in bunches; i.e., flocculate. Water never reaches some particles and many are only partly hydrated. This reduces the effectiveness of the cement, entraps water within the clumps, requires an excess of water for placement and often results in bleeding and segregation. See photomicrograph above.



DISPERSED

With Pozzolith the dispersion principle operates to drive each particle apart, thus exposing all the cement particles to the vital hydrating action and consequently assuring increased efficiency. See photomicrograph at right.

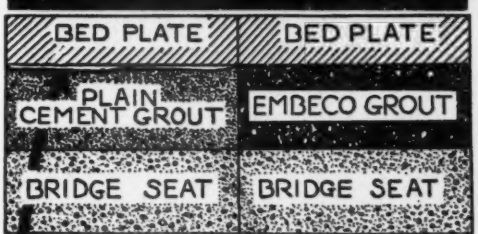
This dispersion, a revolutionary advance in construction practice, makes the cement usable to far greater efficiency since all the water is made available for lubrication of the mix, and the entire surface area of the cement is exposed for hydration.

FIVE ADVANTAGES

Pozzolith added to the cement mix assures these five advantages —

1. Durability increased 50% or more.
2. High Early Strength — 20% or more increase in compressive strength at all ages.
3. Water reduction, up to 20% — slump increased 150% or more for given water ratio.
4. Increased water-tightness — 20% or more reduction in absorption and permeability.
5. Reduced bleeding and segregation.

HOW EMBECO WORKS



Poor contact due to mortar shrinkage, permits increased vibration and rapid disintegration. Embeco produces a lasting bearing surface.

MASTER BUILDERS

HIGHEST REACTIVE SPRING TENSION

UNIFORM TENSION IN ALL BOLTS

HIGHEST REAPPLICATION VALUE

You get ALL THESE ADVANTAGES ONLY in

VERONA *Fixed Tension*
TRIFLEX SPRINGS

SINCE 1873

WOODINGS-VERONA
TOOL WORKS, VERONA, PA.

SINCE 1873

This timber joint

DOES MORE--COSTS LESS

For more than 8 years TECO Timber Connector Construction has been tested by the U. S. Forest Products Laboratory and at many leading universities. The TECO Timber Connector brings into play the full stamina of each framing member by spreading the load on a joint more equally over the cross-section of the wood.

TIMBER ENGINEERING COMPANY, Inc.

Dept. F-11 1337 Connecticut Avenue
Washington, D. C.

Please send full information on the new TECO Connector System of timber construction.

Name.....
Firm.....
Street.....
City..... State.....

It Is Time To Think of

Your **1942** *Requirements*

BARCO

Unit Tytampers

Do A Better Job Quicker In Out Of Face Or Spot Tamping At Lower First Cost . . . Lower Maintenance Cost.

78 RAILROADS USING BARCO

Six Years Satisfactory Service

BARCO MANUFACTURING CO.

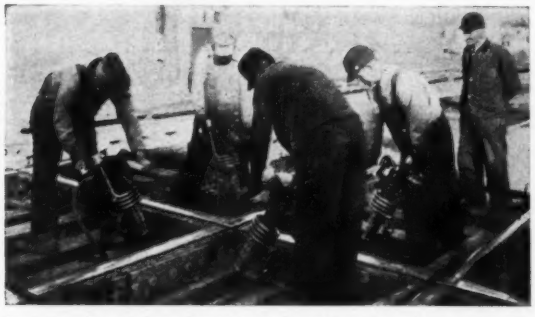
NOT INCORPORATED

1805 W. Winnemac Ave. Chicago, Ill.

IN CANADA

THE HOLDEN COMPANY, Ltd.

Montreal - Moncton - Toronto - Winnipeg - Vancouver



Spot tamping at busy terminals and crossings is quickly and easily handled—no auxiliary equipment in the way.

BARCO Tytampers may also be operated from a small light-weight central power plant for out of face tamping, as shown above. This unit, weighing less than 100 lb., and costing less than $100, is supplying power to 12 BARCO Tytampers.

AID NATIONAL DEFENSE

By Increasing RAIL LIFE

USE R.M.C. PLASTIC

To Eliminate Rail Joint Corrosion

Steel is needed for Defense! Get more life from your present rails by protecting their most vulnerable spot with R.M.C. Plastic.

This specially prepared metal-preserving and lubricating compound completely immunizes rail joints from the destructive action of brine drip, water, weather, rust and other corrosion agencies during entire rail life.

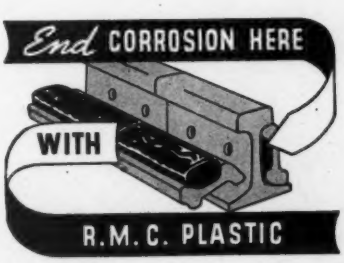
Molded blocks of R.M.C. Plastic are placed on the inner face of the joint bar before bolting it to the rail, the bolting action solidly packing the plastic into every section of the joint assembly. Fishing surfaces, shanks, threads of nuts and bolts are thoroughly protected and lubricated, permitting proper rail expansion and contraction and eliminating the danger of joints "freezing" and causing kinks and humps in the track.

This amazing protection is yours—at a very small cost per rail joint. Write for details.

RAILWAY MAINTENANCE CORP.

PITTSBURGH, PENNSYLVANIA

The above illustration shows the splice removed 8 years after packing with R.M.C. Plastic. Note that rail, joint bar, bolts, and nuts are completely free from corrosion.



TODAY YOU NEED THE DEPENDABLE EFFICIENCY OF...

..DUFF-NORTON TRACK JACKS

DUFF-NORTON JACKS FOR TRACK MAINTENANCE

No. 117—The favorite of railroad men everywhere.

No. 304—Every track crew needs this Side-Lift Jack.

TIE PULLER—Saves time and labor in tie-replacement.

No. 517—Surface and Lining Jack. Will handle heaviest rails.

With traffic breaking all records—and heavier demands yet to come—your track crews *need* the very best tools. This is no time to compromise with quality!

Duff-Norton Jacks, designed and built for railroad track work, are the first choice of railroad men from coast to coast. The smooth, easy action; the sturdy dependability of Duff-Norton Jacks are more important to you *today* than ever before!

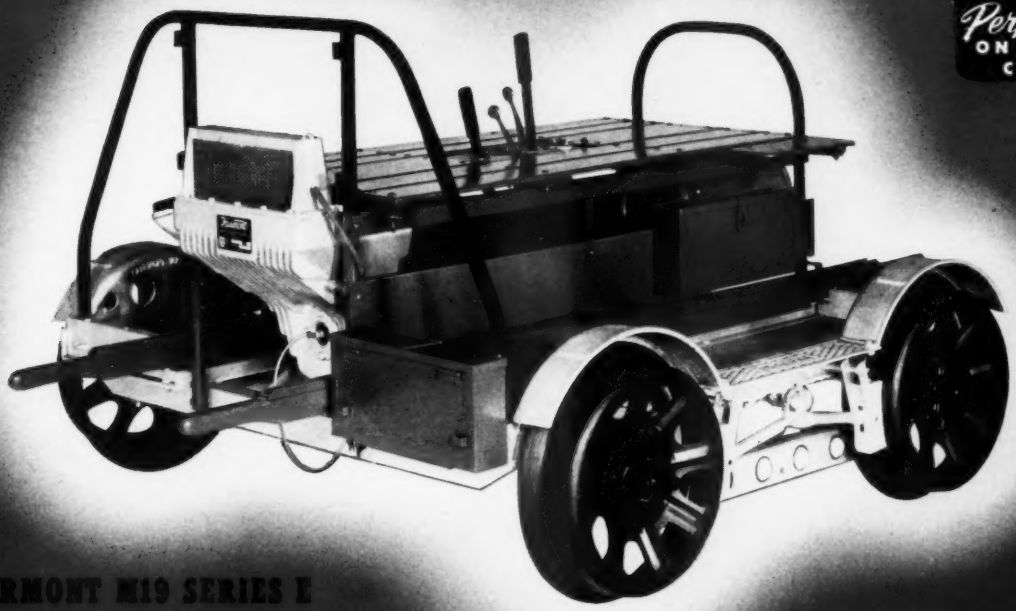
Specify Duff-Norton Jacks for your crews, and insist on *getting* Duff-Nortons!

THE HOUSE THAT JACKS BUILT.

THE DUFF-NORTON MANUFACTURING CO.

PITTSBURGH, PENNA.

CANADIAN PLANT . . . . . COATICOOK, QUEBEC



Performance ON THE JOB COUNTS

FAIRMONT M19 SERIES E

One to Four Men. 700 Lb. Load Capacity.

Fairmont

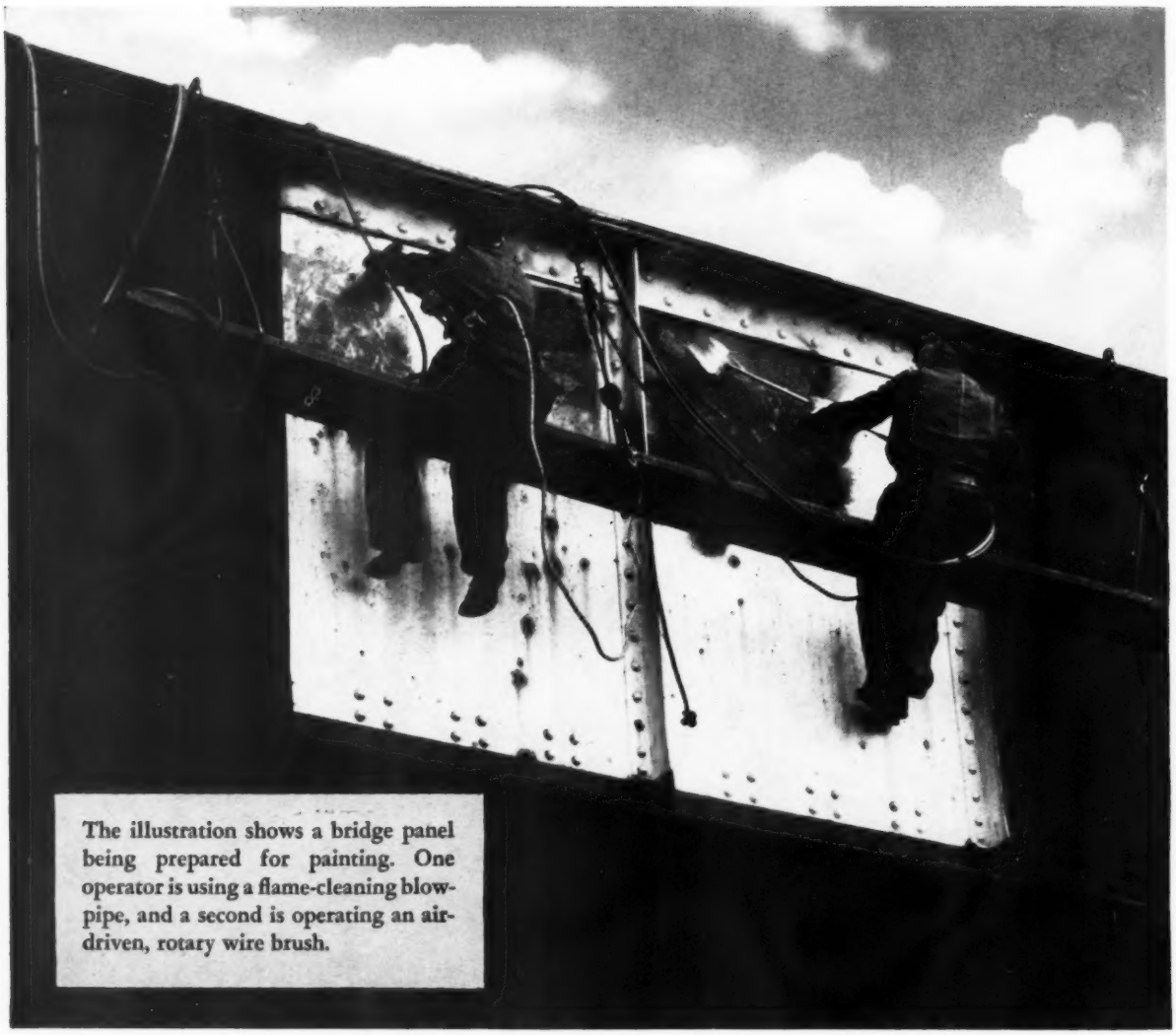
1 TO 4 MEN INSPECTION CARS

MEET DIVERSIFIED NEEDS OF ENGINEERING PARTIES, TRACK SUPERVISORS AND SIGNALMEN

Versatile Fairmont 1 to 4 men inspection cars may be used with absolute safety by single riders. Each has ample power and load capacity to hold the tools and supplies for a crew of four men. Protective features for the safety of the men include: hand rails front and rear, extension lift handles to simplify removal from tracks, rail skids between front and rear wheels, four-wheel brakes, wheel guards and Fairmont's famous differential axle. Because the frame is spring-mounted, Fairmont 1 to 4 men inspection cars offer unsurpassed riding qualities. Fairmont 5 to 8 horsepower engines provide traditional Fairmont economy of operation and maintenance. Fairmont Railway Motors, Inc., Fairmont, Minnesota.

REMOVABLE SEAT TOP allows full accessibility and permits easy adjustments.

OF ALL THE CARS IN SERVICE TODAY ★ ★ *More Than Half are Fairmonts*



The illustration shows a bridge panel being prepared for painting. One operator is using a flame-cleaning blow-pipe, and a second is operating an air-driven, rotary wire brush.

Retard Corrosion and Paint Flaking with OXY-ACETYLENE FLAME-CLEANING

• Oxy-acetylene flame-cleaning, followed by wire-brushing, is being used to free structural steel of loose scale and rust before applying protective coatings. After preparation of the steel by this procedure, application of the paint is speeded up and an exceptionally tight bond is assured on the warm, flame-cleaned surface. Flame cleaning also removes surface moisture, a major cause of corrosion and paint-flaking.

In many cases it makes possible a longer working day since the painters can start to work early without waiting for sunshine to dry the dew.

THE OXWELD RAILROAD SERVICE COMPANY
Unit of Union Carbide and Carbon Corporation
UCC
Carbide and Carbon Building Chicago and New York

OXWELD RAILROAD SERVICE

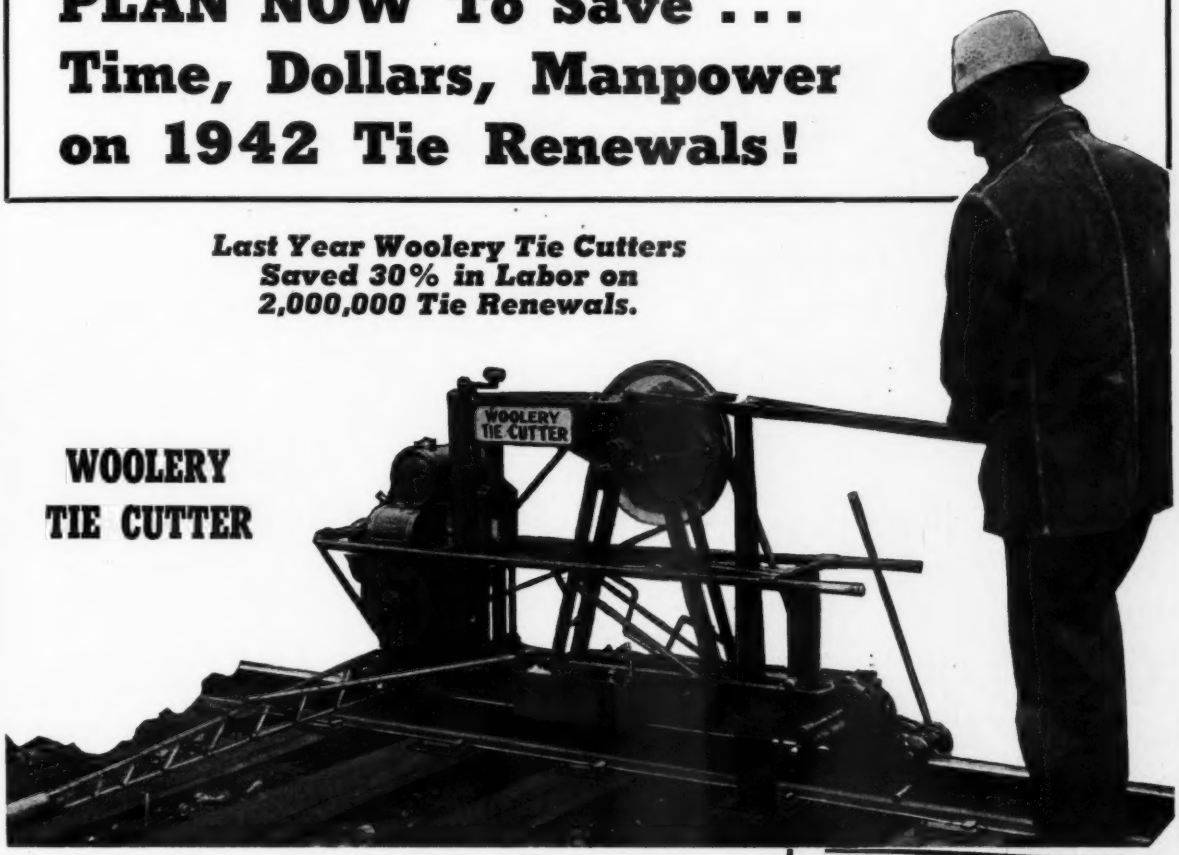
SINCE 1912—THE COMPLETE OXY-ACETYLENE SERVICE FOR AMERICAN RAILROADS

The word "Oxweld" is a registered trade-mark of a Unit of Union Carbide and Carbon Corporation.

PLAN NOW To Save . . . Time, Dollars, Manpower on 1942 Tie Renewals!

Last Year Woolery Tie Cutters Saved 30% in Labor on 2,000,000 Tie Renewals.

WOOLERY TIE CUTTER



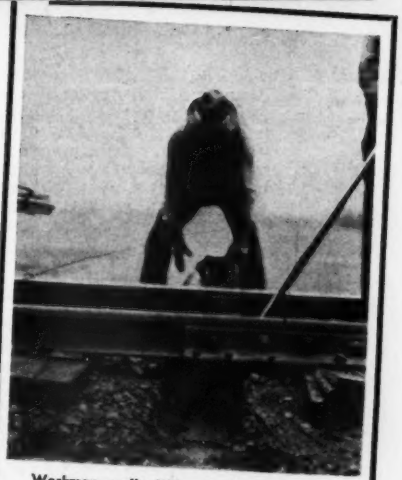
PREPARE NOW for your 1942 Tie Renewal Program! . . . by specifying Woolery Tie Cutters as essential equipment. Records of roads using these machines show substantial all-around savings . . . and work finished weeks ahead of schedule.

The Woolery Tie Cutter is simple and efficient in operation. It cuts the tie into three pieces for quick, easy removal with no disturbance to the tie bed. Digging out of adjoining cribs is eliminated and new ties can be inserted with a minimum of time, labor and tamping. Work is completed sooner and men released for other tasks.

The Woolery Tie Cutter promotes increased life of ties by removing the temptation to renew a tie a year or two before its service life is finished, as so often occurs when ties are dug in.

Detailed Information and Performance Figures on Woolery Tie Cutters Gladly Sent on Request.

Ask for Free Demonstration



Workman easily lifting (not digging out) section of old tie cut by Woolery Tie Cutter. Note how compact the bed remains for easier, more economical insertion of the new tie.

WOOLERY MACHINE COMPANY

MINNEAPOLIS — Pioneer Manufacturers of — MINNESOTA

RAILWAY MAINTENANCE EQUIPMENT

TIE CUTTERS • SWITCH HEATERS • MOTOR CARS

RAILWAY WEED BURNERS • BOLT TIGHTENERS

No. 155 of a series

Railway Engineering and Maintenance

SIMMONS-BOARDMAN PUBLISHING CORPORATION

105 WEST ADAMS ST.
CHICAGO, ILL.

November 1, 1941

Subject: An Inquiring Turn of Mind

Dear Reader:

Have you ever heard a maintenance officer say that our methods have become so standardized today that little further progress is to be expected? If so, did you accept such statements as true—or have you challenged them?

Within the last few days I have taken a trip over one of our railways to study its maintenance practices. It was not among our largest railways—neither was it among the smallest. I visited this railway because I knew that it was doing a lot of things in interesting ways, and I wanted to see first-hand what it was gaining from these innovations. I found all that I had anticipated and more. Most interesting of all to me were the inquiring minds that I found back of all these interesting departures from established practices—minds that are open to and actively seeking still more departures that give promise of better results.

In an industry as complicated as railroading, experience is vital to the success of every supervisory officer, for he must know how to do most efficiently the work entrusted to his care. Yet this experience tends to narrow one's horizon and to confine him to the rut traversed by his predecessors. If this experience is to prove its greatest value, it should serve as a foundation on which to build newer and still more efficient methods, guiding one in the directions in which greatest improvements are possible.

But, I imagine that some of you will say that procedures have been so standardized through the process of trial and error during the years that little further progress is possible. Is this true? Have we reached or even approached the limits of practical perfection? Have we, for illustration, developed the full possibilities of work equipment to provide the most efficient maintenance of our properties? Do we know our costs with sufficient accuracy to determine with certainty which of several methods are most economical? Do the materials we use meet our requirements in full or are there deficiencies which warrant correction? Are we accepting what we have as satisfactory or are we endeavoring to discover shortcomings as a step towards their elimination? In other words, are we complacent with today's practices or are we of a sufficiently inquiring mind to endeavor to find better ways?

Throughout the ages, progress has been made by persons who were dissatisfied with the existing order. It is these same persons who are constantly raising maintenance practices to higher levels. It is these men whose discoveries are described in our editorial pages from month to month. And as we review these developments, do you share my conviction that there is still much to be done; in other words, that we still need men of an inquiring mind in maintenance of way activities?

Yours sincerely,

Elmer T. Howson

Editor

ETH:EW

MEMBERS: AUDIT BUREAU OF CIRCULATIONS AND ASSOCIATED BUSINESS PAPERS, INC

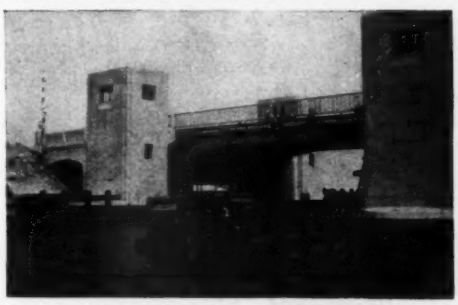
Don't Paint ANOTHER STRUCTURE UNTIL IT HAS BEEN PROPERLY RECONDITIONED BY AIRCO Flame Cleaning

These instructions might well come from the "brass hats" in any number of leading railroads. For the executives of many such roads have already solved their metal painting problems by preparing surfaces with the Airco Flame Cleaning Process before repainting. And wise advice this would be, because this economical process is the most effective method yet devised to prepare metal surfaces for long lasting paint jobs.

Utilizing a high temperature flame, Airco Flame Cleaning removes rust and scale, and dehydrates as it cleans; it leaves the metal surface dry and warm, conducive to a lasting paint job. This process is highly flexible, size or shape of the object to be cleaned make no difference. The apparatus with which it is applied is light, standard, portable and easy to operate.

Members of Air Reduction's Railroad Service Department are available to assist in the proper application of the process so that it will be most effective wherever used. Further information will be gladly given upon request.

Rust conditions such as this are common—yet paint which will protect against corrosion cannot last long when applied to the surface in its present condition.



Spanning a salt water inlet, this bridge is subject to harsh exposure. Because it was flame cleaned prior to repainting, the present paint job will outlast its first many times.

Air Reduction

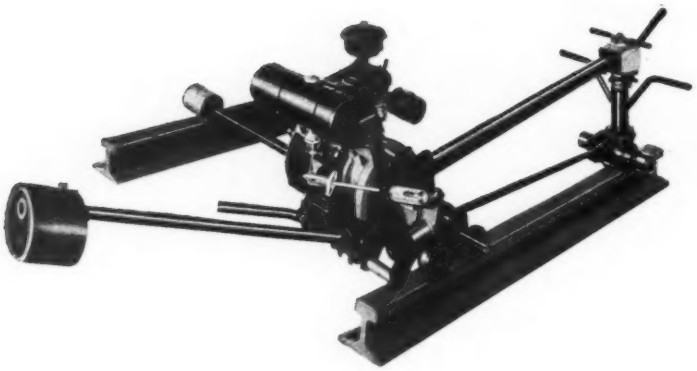
General Offices: **60 EAST 42nd ST., NEW YORK, N. Y.**

DISTRICT OFFICES IN PRINCIPAL CITIES
In Texas: MAGNOLIA-AIRCO GAS PRODUCTS CO.

AIRCO WILSON

SERVING RAILROADS FROM COAST TO COAST

Raco Power Track Machine



The Raco delivers an exactly uniform power to every nut.

The new Raco Micro Cutout is easily applied to old machines with wrenches and screwdriver. **There are no obsolete Raco Machines.**

Light weight, fast, accurate, smooth operation, quality construction.

Purchased by 59 railroads.

Raco Tie Boring Machine

Bores holes for **screw** spikes or **cut** spikes.

Bores ties in track more than **twice as fast** as any other accepted means.

Bores holes **absolutely vertical.**

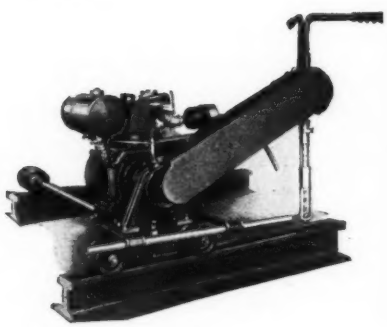
Locates all holes **exactly in center** of tie plate punching.

Automatically **controls depth** of hole.

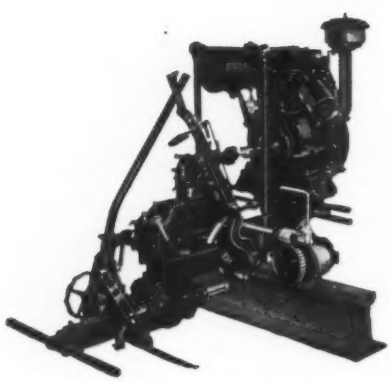
Chips are blown away as fast as made, leaving hole clear.

One-man operation.

Machine can be removed from track by one man.



Everett Power M-W Machine



For fourteen years the Everett M-W has been the **standard** power rail drill on practically all railroads.

Its design and construction insure the utmost in facility of operation and in speed and accuracy of adjustment.

It has made such astonishing records for economy that **no road can afford to use any other means for drilling bolt holes.**

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NOVEMBER, 1941

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Railway Engineering and Maintenance

A Challenge

Maintenance and National Defense

WHETHER we want it or not, we are moving rapidly toward war, if we are not already in its early stages. Nation-wide, all other activities are being subordinated to those of national defense. Men are being drafted into the armed forces; vast industries are being diverted from peace-time activities to the production of equipment essential to war and materials are being so rationed as to give first consideration to the needs of armed preparation. In every respect we are in a state of near-war and intensive preparation for war.

Railways Play Vital Part

In these preparations the railways play a most vital part. Men must be moved to camps for training, and from camp to camp in the process of their training. And materials must be moved from sources of raw supply to points of fabrication and utilization in vast quantities and for long distances with regularity and dependability. In most instances these materials must be moved at least five or six times in the process of their conversion from the ore or the tree to the plane, the gun or the shell. All this requires railway service of a high order—a service that is just as essential to military success as the movement of the combat forces themselves.

In the provision of this transportation service, every railway employee bears a direct responsibility to so perform his own work that no shortcomings in service may result therefrom. While the public measures transportation service in terms of cars moved, every maintenance man knows that no railway service can be better than the tracks and structures over which these cars are moved. It is his very direct responsibility, therefore, to do all that he can to insure that no delay shall be created by any defect in tracks and structures that will retard the orderly movement of traffic.

Contrasts with World War I

From the national standpoint, the problem placed before the railways is comparable with that which confronted them during the World War of a quarter century ago. Yet marked contrasts exist within the railway industry. In the first place, the railways had 2,250,000 cars available for service in 1917; they have 1,600,000 today. Similarly, in 1917 they had 62,000 locomotives in service; today they have only 42,000. It is evident, therefore, that the cars and locomotives that are available today must render vastly more service per unit—and that delays and inactivity cannot be tolerated.

Turning more specifically to roadway, the railways entered the war in 1917 after years of rising traffic and earnings, with the result that money was available for adequate maintenance and they were in better than normal physical condition. Today, however, the railways are emerging from 10 years of acute depression, during which appropriations for upkeep of tracks and structures have been restricted to the barest necessities. Furthermore, during the latter years of this decade, the demands of faster speeds have forced the concentration of such money as has been available on these facilities that contribute to faster operation, accentuating still further the neglect of other facilities. As a result, in many respects, the properties are far less adequately prepared to meet the demands of a greatly enlarged traffic than they were in 1917. Yet the national emergency is such that results, rather than alibis, are demanded and maintenance forces must organize to take these added obstacles in their stride.

Analysis of Problems

To do this with the determination that has long characterized the entire railway industry, and that has been especially pronounced among maintenance men, through long schooling in combatting storms, washouts and blizzards, requires careful analysis of the problems that exist today and then determined planning and prosecution to meet the demands, revising methods where necessary to meet the changing conditions of today. That man, that gang and that division will make the greatest progress that constantly reviews its methods to determine if they are the ones best adapted to the work of today.

Doing this, one faces first of all the necessity for insuring that the tracks and structures are at all times of strength adequate for the needs. There is no time to be lost now through derailments or other interference with the orderly flow of traffic because of inefficient, careless or inadequate upkeep of the tracks and structures. A railway is a composite of so many activities that a failure is equally serious in a water station, a coaling

facility or an enginehouse, as in the track, if it results in a delay to traffic. All these facilities must be so maintained that they function as intended when needed.

Maintenance forces face also the upkeep and strengthening of their properties at a time when materials are increasingly difficult to secure and delays in deliveries are to be expected. It is true that the government has given railway needs priority ratings as agencies of national defense but priority ratings alone do not bring materials automatically. Maintenance forces must anticipate their needs further in advance in order that time may be allowed for their procurement. In places it may also be desirable or necessary to revise plans or practices to substitute materials more readily procurable. Whatever the proper expedient may be, it is essential that the planning be done with such intelligence that there be no failure or loss in efficiency due to lack of those materials that are vitally necessary.

No Slow Orders

At a time like this when the railways are being pressed to use all their equipment with maximum intensity, it is highly important that maintenance forces so conduct their operations as to reduce slow orders to the minimum. This will require the revision of many methods; it may add somewhat to the cost of the work. It is, however, an essential step in the development of the maximum traffic-handling capacity of the railways. For the same reason, it is imperative that the use of cars and locomotives in work train service be reduced to the absolute minimum. Likewise, cars carrying company materials should be unloaded immediately on arrival at destination, even though it may cost more to send men for this specific purpose. The railways should set an example for shippers in this respect; yet in many instances it is reported that they are less efficient in releasing cars today than shippers. Such delays should neither be condoned or tolerated.

And maintenance officers should be no less attentive to the use of labor. At a time when men are leaving their gangs for war industries and their forces are being depleted, they cannot afford to risk failure in completing scheduled work because of a lack of men. Rather, they should now study more intensively than ever before how to make the most efficient use of the men they have by supplementing their efforts with machines. This calls for the addition of many machines where forces are not adequately equipped today; it calls also for the replacement of old, outmoded machines with others of more modern and more efficient design. The demands of the present call for the survey of all equipment on hand to determine its adequacy in all respects in order that the maintenance program may not fail in its last stages after all materials have been secured because of lack of labor and equipment for its application.

A New Order of Thinking

In all these and many other respects, the problems confronting railway maintenance forces require thinking of a new order today—thinking that will enable them to meet the new and more intensive demands with determination that, come what may, there will be no failure of the railways because of neglect on their part. As we approach more closely to a "shooting" war, the responsibilities placed on maintenance of way forces compares with that of men in the trenches, for a war can be won only as these men are supplied with the materials and equipment that they require. Maintenance of way forces have long held the admiration of managements and public alike because of the heroism with which they have attacked washouts and blizzards; they are entering a similar period now in which there must likewise be no failure, no turning back until the job is done. National security is at stake.

Switch Heaters

Essential to Winter Terminal Operation

IN SPITE of the fact that maintenance of way men are busier today than they have been at this season for many years, with much program work still to be completed before snow flies, it is not too early to look ahead and plan for those very days that will halt many phases of active track work, and which may even halt or seriously interfere with train operation if adequate precautions are not taken. What the coming winter holds in snow, sleet and protracted cold, no one can foretell with accuracy, but that it will be a winter of unusually heavy traffic, stimulated by the country's national defense efforts and increased industrial activity generally, seems certain. With this situation in prospect, and particularly in view of the emergency character of much of the traffic that will be handled, there can be no gambling with the weather if the railroads are to meet the demands that will be made upon them.

Snow storms are no respecters of those localities subject to heavy snow falls; they bury countryside and cities alike, and are a "nightmare" to roadway maintenance men everwhere. However, while severe snow storms may cause operating difficulties out on the line, especially in mountainous country, it is in the terminals, with their multitude of switches, interlockings and yard facilities, that most roads can be affected most adversely. More than at any time in the past, terminals have become the heart of railway operation, and any delays at these points have the effect of slowing down operations over the entire line. Coming at a time when the railways are making every effort to increase the daily movement of cars, a severe tie-up in a terminal, due to winter storms, can offset all efforts in this regard and place the railway at a serious disadvantage.

In earlier years, with less adequate means of ascertaining the progress and probable severity of storms, and the necessity for dependence largely upon manpower with brooms, shovels and salt to keep switches and interlockings open, terminal tie-ups were not uncommon in spite of heroic efforts and a severe tax on the physical endurance of the men. Even today, where these manual methods of attack are still relied upon, the threat of tie-ups is in no wise lessened. In fact, in the face of a possible shortage of readily available manpower during the coming winter months, the threat is increased materially.

The fact that there need be little serious threat to winter terminal operation today if a road utilizes the wide variety of snow fighting equipment that is now available,

has been demonstrated by a number of roads which have made large-scale installations of such equipment. While all of this equipment has its place under special conditions, the one type that has universal application and unquestioned advantages is the switch heater or snow melter. This device, now available in a variety of types and suited to installation under practically all conditions of switch arrangement or location, has proved its effectiveness in keeping switches open and operative under the most adverse conditions of heavy snow falls, high winds and low temperatures. Furthermore, and of the greatest importance, it has proved its effectiveness with minimum or no manual attention, which makes it possible to reduce, if not eliminate, the large emergency forces required formerly to keep switches open.

Thus, no matter what other types of snow-fighting equipment a road may choose for its lines as a whole, it cannot afford to attempt to get along without adequate snow-melting devices at strategic points throughout its more important terminals, and at many outlying points reached only with difficulty. To attempt to do so is to gamble that adequate emergency manpower will be available during the coming winter to cope with storms, and conversely, that train delays, if not complete interruption to service, will be encountered, in spite of all of the manual efforts that can be mustered.

Water Shortages

Should Not Be Allowed to Persist

ALTHOUGH the present severe and widespread drought appears to be broken, at least temporarily, in some sections, there has been little or no relief as yet in others. Over wide areas there has been an annual deficiency of rainfall for several years, and this deficiency has been relatively greater so far this year. As a result, the ground-water table in these areas has receded, streams have ceased to flow or have been reduced to unusually low-water stages, and reservoirs have failed or are approaching failure. In consequence, not a few railways, municipalities and power companies have been hard pressed to obtain the water necessary to enable them to carry on their normal operations.

Water and fuel are essential to train operation, yet they bear little relation to each other with respect to source and delivery. Fuel is obtained from many sources and can be delivered to the point of use from any of these sources. On the other hand, water must be obtained locally and, in general, can be delivered from a given source to only one point on the railway. This makes it all the more desirable that the local supply be dependable, since a shortage or a failure of water at one station cannot be made up from some other, no matter how abundant the latter supply may be, except at a high and uneconomical cost that often borders on the prohibitive.

Recurring droughts during the last 10 or 12 years have disclosed many weak spots in railway water supplies. On the whole, however, revenues have been so low that managements have been reluctant to release the funds necessary to put these supplies on a dependable basis, particularly in view of the reduced water consumption resulting from the recession in traffic. The result has been that the severity of the present drought, coupled with a sudden and record-breaking increase in traffic, has greatly aggravated the water shortages at many points.

With present revenues far above those of recent years, and with the prospect that they will continue at this or a higher level for some months to come, water service officers should now emphasize to their managements the need for improving the dependability of their supplies at this time to avoid the recurring shortages that have been more or less frequent in the past. If this can be done, it will eliminate many of the anxieties under which they have labored. It will also be good business to make a continuous supply of water a certainty, even under the most adverse conditions likely to arise.

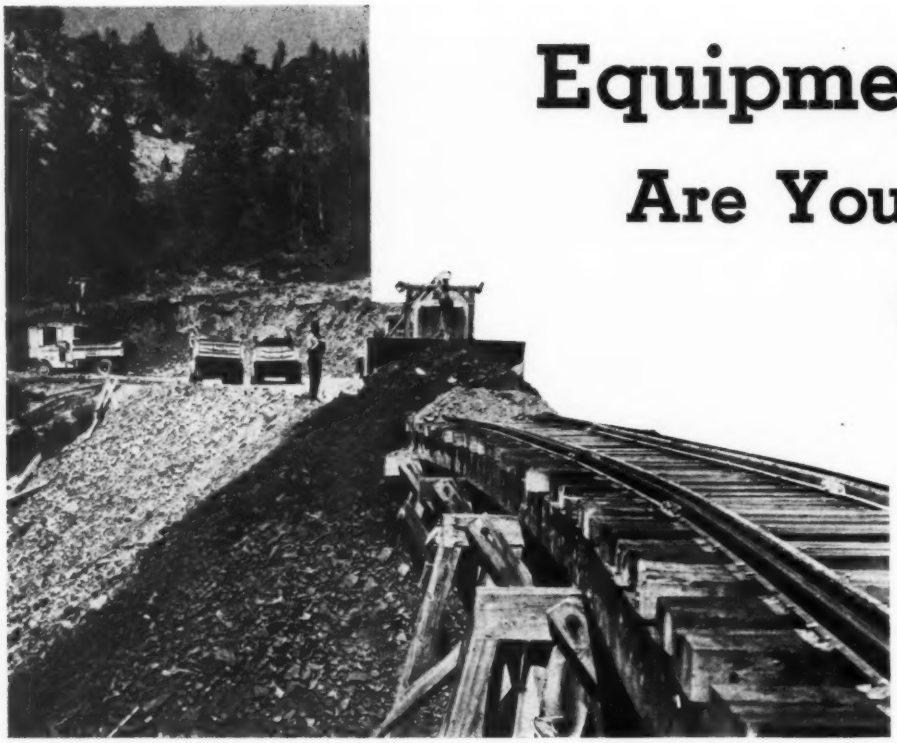
Thermal Insulation

Now Is a Good Time to Make a Start

PROBABLY no single subject relating to building construction and maintenance, except painting, has been discussed more widely or more persistently among railway building officers during the last few years than that of insulation. Yet little has been done about it and the railways continue to lag far behind most other industries, particularly home building, with respect to the use of thermal insulation.

Activity in the railway building field is greater today than at any time during the last 12 years, with every indication that it will be still greater next year. During this period many buildings that were not being used, and for which no further use could be foreseen, have been dismantled, partly to eliminate maintenance charges, partly to reduce the units of property upon which taxes are paid and partly to salvage materials that could be used for other purposes. During this period also, building maintenance has been held to the minimum, with the result that a large number of the buildings that remain are in need of extensive repairs. Because of sharply increased traffic and of the development of new methods in transportation, it is becoming necessary to remodel or enlarge not a few of these buildings and to construct others, to meet the demands that are being made upon the railways for the expeditious handling of this traffic.

While, in general, thermal insulation will give larger returns when applied to frame buildings, it can also be justified for those of the more permanent types. When extensive repairs become necessary or when a building is being remodeled or enlarged, an excellent opportunity is afforded to apply insulation in the form most suited for the structure involved. Fortunately, this material is now available in many forms, so that building officers have a wide range from which to select the particular material they consider will be most suitable for the conditions with which they are confronted. Because of the savings that can be made in fuel consumption by reducing heat losses from buildings of practically every type and size, the installation of thermal insulation should be given thorough consideration whenever major repairs or alterations are to be made to any structure.



Equipment—

Are You Making Of What

In the Face of an Equipment and Labor Shortage, It Is Essential That All Presently Owned Equipment Be Maintained to a High Standard and Utilized to the Fullest Possible Extent

G. R. Westcott

WE find ourselves today with a large variety of machines, some of which have been adapted to railroad work from their previous use in other industries, while others have been designed especially for specific jobs. On these machines we have come to place great dependence.

In the near future, it is quite possible that there may be added other factors making the use of equipment still more important. Just as we have turned to equipment in the past to help balance the need for greater production against reduced allowances, and for assistance in securing the track conditions necessary for increased speed and heavy loads, we may discover shortly that equipment must be used to replace labor which, in the quantity needed, cannot be secured at any cost. In other words, we may find that we must further increase our use of mechanical devices if additional devices can be secured or, if they cannot be had, that we must give more intelligent care to the machines we have to permit making more intensive use of them. The limit to which equipment can be used in maintaining our tracks and structures has by no means been reached. There are still many jobs being done by hand that could be done more cheaply and better by machines.

*Abstract of an address presented before the fifty-sixth annual convention of the Roadmasters' and Maintenance of Way Association, in Chicago, on September 17.

Development Slow

The machines that we require in our work are, in many cases, so specialized that they are not adaptable to use in other industries, and for this reason their development has been slow. A considerable part of our equipment was developed for use in other industries, and, with such modifications as were required, was adapted to our needs. Here again, the peculiar needs of the railroads delayed its adoption. The size and type of grading equipment favored by contractors for example, do not adapt it readily to use on the restricted areas of our rights of way. Only in the last few years have a few manufacturers recognized the potential market for equipment on the railroads and begun a serious study of our needs in an earnest effort to meet them. That is one thing for which we can, in part at least, thank the depression; the lack of other markets interested a few manufacturers in the development of machines that could be sold to and used only by the railroads.

There are some things we know with certainty that we must face in the maintenance of these machines. There are others that we may hope to escape, but must be prepared to face. We may know with reasonable certainty that we face higher costs for additional machines and for the parts required for the maintenance of the machines we have. In spite of price ceilings and the efforts of price administrators, the old law of supply and demand still operates. The unprecedented demands of our all-out defense program for the same materials that we require for the maintenance of our machines already exceed the supply. Price increases are inevitable, and we can only hope, perhaps with reasonable assurance, that these increases will maintain a fairly consistent balance with the economic conditions of the times.

We may know with certainty that we face delays in securing machines and parts, due to the priority regulations of the government. Materials for maintenance of way purposes on the railroads, including those for the maintenance of our equipment, do not enjoy a very high priority rating. Even though a higher rating may be given later, delays will still persist. No longer does the purchase of materials call simply for a meeting of the minds of the buyer and seller. Now, in addition, each must present evidence to satisfy an inquisitive government

the Most You Have*

Proper Operation, Lubrication and Care Are Essential to Maximum Machine Production

In this paper, the author tells maintenance of way and structures men of the problems they are facing in equipment; offers numerous suggestions to alleviate delays and shortages; and bluntly challenges them to get the maximum out of the work equipment they now have

By G. R. WESTCOTT
Assistant Engineer
Missouri Pacific, St. Louis, Mo.

agency that the transaction meets the regulations of the moment. All this takes time.

We face delays in the delivery of machines and parts due to delays that will be experienced by manufacturers. In most machines, and often in parts or accessories, there are castings, forgings or other items which the manufacturer does not make in his own plant. These must be secured from some other manufacturer, and delays in the receipt of them must be expected. Meanwhile, we will wait. We face delays due to generally upset market conditions. Often the source from which we have secured a product customarily will no longer be able to furnish it, and another source must be found.

Redesigned Parts

We face delays because of the manufacturer's difficulty in securing certain materials. If these materials are still available, we may have only to wait until the manufacturer finds a source from which they may be secured. If, however, the manufacturer has been progressive in the past in the introduction of aluminum and lightweight, high-strength alloys in his product, the redesigning of his product, or parts of it at least, may become necessary to make use of such materials as may be available. Such redesigning takes time under the most favorable conditions, and with the manufacturer harassed by changes in personnel, changes in sources from which he secures his materials, and, in many cases, with more orders than he can handle, the conditions cannot be said to be favorable.

Added Delays

We face delays in the field application of redesigned parts. Such parts may often not be strictly interchangeable with the parts they are to replace, or their greater weight may destroy the balance of the design, making changes necessary in other parts of the machine to permit their use. The delays I have outlined build up in a sort of geometric ratio, each reacting on the other in such a way that the total is considerable. Therefore, unless all means available are taken to overcome them, they may seriously handicap the operation of our equipment.

We face an almost complete standstill in the development of new machines for specific jobs on the railroad. The development of such specialties calls for engineering service and materials that are now fully employed in defense industries. Large and important as the railroad industry is, it does not offer a market large enough to attract a manufacturer who, for the asking, can secure defense contracts sufficient to keep his plant operating at full capacity—if, indeed, such defense contracts are not forced upon him by the government.

Face Heavier Machines

We face a return in some degree to machines of heavier design. Our dream of machines of extreme lightness and portability must await the time when the lighter metals and alloys are again available. We may face, though we hope to escape, a complete inability to secure additional machines, and possible inability to secure parts to maintain those we now have.

The need for greater refinements in line and surface and stability played an important part in bringing about the adoption of power tools and equipment. We have tried power and we like it. To return to the "pick and shovel" days would, perhaps, make it necessary to lower somewhat the standards of maintenance that we now consider normal. In the extreme, we might find it impossible to handle traffic at the speeds now obtaining; but if such a situation should arise, it would probably be comparable only to changes brought about in other industries by the requirements of the defense program.

We may face, though we hope to escape, the necessity of using some equipment not well adapted to railroad use. During the last few months a large quantity of equipment has been purchased and used by contractors on

government projects. There must be an end some time for the need for this equipment, and, for a time at least, it may become available for use on the railroads. Even though a shovel or tractor or some other piece of grading equipment may not be just what we would buy if the usual market were open, and from the viewpoint of railroad use not entirely suitable, we may be glad to get it in the emergency.

Relief Measures Necessary

In all, the situation does not look too bright, and we may well ask ourselves what measures can be taken to relieve, in so far as possible, the difficulties that appear to lie ahead. While the suggstions to follow are applicable particularly to the maintenance of roadway and track, and are directed to you as the supervisory officers in charge of such work, they may be considered to apply also to the maintenance of buildings and other structures where equipment is involved.

The introduction of mechanical equipment has, in many cases, outrun the organization and supervision necessary for securing the greatest possible return on the investment. Too often, the supervising officer thinks of the machine only in terms of the number of men it will replace; he gives little thought to the money invested in it, to that spent in maintaining it (unless by chance that comes out of his allowance), or to whether its use is programmed in such a way as to utilize it fully and produce the greatest possible volume of work.

Must Make the Most of What We Have

In preparing for any undertaking, it is the current fashion to adopt a slogan. In facing our undertaking, I suggest the slogan, "Make the Most of What You Have." I hear you say, "We always do that." I will agree that you are adept at getting along with less than you think you should have, or less than what you would like to have. I know that as maintenance men you must be and are resourceful, and are accustomed to meeting emergencies with courage—but do you make the most of what you have?

Let us examine this a bit, keeping in mind, as suggested before, that you may be delayed in getting additional machines or quite unable to secure them, and that you will certainly be delayed in getting repair parts for the machines you now have.

My first inquiry is not directed to you alone, but to your supply department and to your management as well. Are you properly organized for servicing your equipment? For example, have you an adequate supply of repair parts on hand at your stores? When a machine is out of service for lack of a part that is worn out or broken, to secure that part from your stores stock by baggage shipment is one thing; to get it from a manufacturer, possibly a thousand miles away, who can make delivery only when he gets a long-delayed shipment from some other manufacturer, and who must meet priority requirements, is quite another. Between these two conditions may lie from one or two days to a month of idleness for the machine.

Machines Should Be Checked Regularly and Frequently and all Necessary Repairs Made to Insure Their Most Efficient Operation

I am not advocating hoarding, but I am suggesting one means of overcoming the abnormal delays that will result to your equipment if it is necessary to go to the manufacturer each time a replacement part is needed. In recent times of easy communication and fast transportation, we have, to some extent, grown into the unfortunate habit of leaving the company stores out of consideration in the maintenance of our equipment. Unfortunately, too, we have given little thought to the problem of repair parts in the purchase of our equipment, and in too many cases have bought one of each of the different makes available. It is too late to correct these conditions fully, but we can examine the situation carefully, and, where possible, protect the operation of our machines by maintaining a suitable stock of replacement parts at our stores.

Are Lubricants Available?

In addition to the foregoing, are suitable lubricants readily available? With machines of many makes, sizes and types, many different types of oils and greases are required. While it is desirable that the number of types and grades of lubricants in stores stock be held to a minimum, it is essential, to avoid unnecessary wear of parts and to insure continuous service, that for each piece of equipment, lubricants be furnished that are fairly close in grade and quality to the manufacturer's specifications.

But you say, "These things are not my worry, they belong to the supply department"—and the supply agent says the management will not permit any increase in the stock balance. True, to an extent, but whatever your job may be, you can often help. Perhaps a word from you to the right officer, pointing out that you are having delays in securing parts, or that suitable lubricants are not carried in stock, will finally reach the man who can say, "Yes, those materials should be stocked."

The man you approach in this regard will probably ask, "Was the need for that part discovered as soon as it should have been, and was the part ordered promptly?", or, "Has the trouble with the oil or grease furnished been called to the attention of the proper officer previously?" Unless to such questions you can answer, "Yes Sir," with truth and emphasis, it is evident that you are not making the most of what you have.

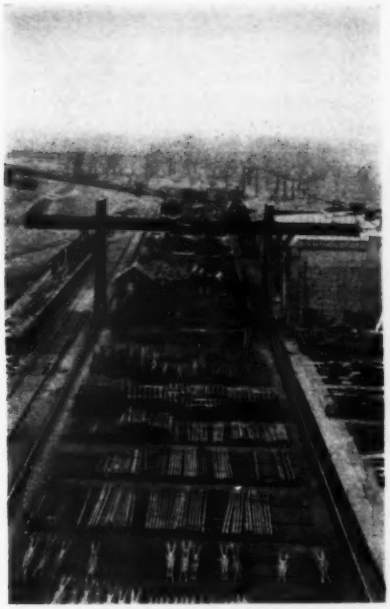
How About Planning?

My second inquiry is—Is your work planned carefully and a comprehensive program made up with the view to keeping your machines, and perhaps the gangs with which they work, busy? I know this is often a district or system matter and that the final responsibility rests with the district engineer or the engineer maintenance of way. They are accustomed to considering the work and making the programs from the viewpoint of the district or the system. Do

(Continued on page 782)

What We Face In Materials*

By E. A. CLIFFORD
Chief Purchasing Officer
Chicago & North Western System



Maximum Service Must Be Exacted From Every Piece of Equipment and Material

Tells roadmasters in convention of the government orders and priorities that are affecting, and which are certain to affect more seriously, the normal supplies of tools and materials for the railways, and urges their greatest cooperation in care and conservation to the end that adequate upkeep of their properties will not be affected adversely by shortages

E. A. Clifford

WE are in a critical period and facing conditions that may be a great deal more serious as time goes on. Conditions that have no precedent in the world's history, the dislocation of every phase of business, and even our very way of living, are in front of us today in a manner that was never known before.. What the ultimate outcome will be, no one but the Great Creator knows.

It is a time that requires all the skill and intelligence we possess, and even with our best efforts we will probably stumble along and progress by the way of trial and error. It is important that we keep in mind always the part that we must play in this situation, and that is, the preservation of the efficient operation of our great American railway systems, so important to our national security and the perpetuation of our normal way of living.

One of the very important, if not the most important, matters for our consideration at the moment, is our inability to obtain the necessary things to keep our railroads in proper and efficient condition to carry the load we expect to be heaped upon us. We have already taken many of the steps that have been and are still open to us, and we have made some progress, but as we go along we are encountering obstacle after obstacle that try our patience. We must not be discouraged, but rather must employ our greatest intelligence and ingenuity to overcome them.

Government Control of Materials

Agencies have been set up, principally the Office of Production Management, for the purpose of controlling and regulating the distribution of material that is so scarce at the present time because of its need for national defense purposes. From personal observation I have no hesitancy in saying that the many men employed in these agencies are working hard, intelligently and carefully to find a way that will produce the greatest good for the greatest number, having always in mind first, of course, our defense requirements, and second, in-so-far as possible, to prevent a complete reorientation of business methods and practices, and to avoid inflation.

Those in charge of the control and distribution of material generally did not jump at conclusions, but rather approached this colossal task step by step in a careful and painstaking way, taking each step carefully as to the result. Now, and speaking primarily of steel, they seem to have reached the last step by taking complete control of all steel to the end that all defense orders will be shipped before any civilian needs are provided for—and, of course, the railways are considered an arm of our national defense.

Orders Issued

The first order was known as General Metals Order No. 1, which consisted of a form sent to each supplier for a tabulation of such items as he estimated would be needed that or the following month—items that had already appeared on the Priority Critical List. The purpose of this order was what might be considered a means of controlling the inventories of all users. The second step was known as the General Steel Preference Order, and the first one to intimate that the Office of Production Management was preparing to take a hand in the delivery, distribution and issuing of priority orders to consumers and manufacturers.

Among the several orders that have been issued subsequently that are certain to affect railroad operation and maintenance are: General Preference Order M-14, dealing with high-speed steel; Machine Tool Pri-

*Abstract of an address presented before the fifty-sixth annual convention of the Roadmasters' and Maintenance of Way Association in Chicago, on September 17.

ority Order; Order M-5 and M-5-a affecting nickel-bearing steel; General Preference Order P-8, Freight Car Construction and Repairs; Preference Order M-9, affecting copper; Preference Order M-15, affecting rubber; Preference Order M-11, affecting zinc; Preference Rating Order P-21, concerning material for the building, rebuilding and repairs of locomotives; General Steel Preference Order M-21, taking almost complete control of steel to the end that defense orders get the right of way; and Maintenance and Repair Rating Plan P-22, assigned an A-10 rating. Orders with the prefix "M" indicate that the material affected is under government mandatory control for defense purposes.

Maintenance Affected

Maintenance and Repair Rating Plan P-22-a is the order that applies generally to your branch of railroading. This plan, issued and subsequently withdrawn or delayed, was issued to several prominent industries and the railroads, and provided an A-10 rating for all material required for maintenance, repairs and renewals in the operation of these industries. It is assumed that this plan will soon be released, and it is my hope that when it is, we will get better than an A-10 rating. However, it is my personal opinion that the A-10 rating, under present circumstances, when and if granted, will be equally as good as the A-3 has been. I mean by that, that the stricter control of steel should make a greater quantity of it available for defense needs than heretofore.

General Steel Preference Order M-21 is the first order that actually puts the distribution of steel under mandatory control and places in the hands of the Office of Production Management complete control and actual command of the industries that make or use steel. Under it, it can restrict the quantity of steel going to any industry when steel producers are holding orders for defense material, and, as I see it, thereby controls the production of automobiles, passenger buses, trucks, washing machines, ice boxes, etc. It is a very potent order, with plenty of teeth, and one cannot visualize such power without realizing the responsibility placed in the hands of the Office of Production Management and the Director of Priorities—nor can one think of it without at the same time realizing the gravity of a situation that makes such severe tactics necessary. These orders also remind one of the necessity for the careful use of all materials and of their conservation for further use, and bring about a realization that it may at times be expedient, as well as prudent, to spend more money to put a tool or bar in proper condition for use than the cost of a new one, because of the inavailability of the new material required.

No Deliveries Guaranteed

I hold no brief for or against the methods that are being employed, but I praise the painstaking efforts that are being made to carry out this colossal task and sympathize with those who are charged with the responsibility of carrying out the Priority system successfully. It must succeed, because I think that the success of our transportation system depends upon its successful solution. One thought that I wish to leave indelibly in your mind is the fact that to secure a priority rating does not by any means guarantee the delivery of material. In fact, the A-3 rating, which is the most favorable one assigned to us, means there are practically 15 ratings that enjoy a better standing. This will give you an idea of how long we may have to wait for the things we need.

A Careful and Frequent Inspection of Scrap Bins May Many Times Reveal Much Usable Material.

Makes Suggestions

To conserve what we have we must be more careful than ever; we must avoid misuse and unnecessary wear and breakage; we must do everything reasonable to protect material from rust and decay, to extend the life of material. I can think of many things to be done along these lines. Take, for instance, angle bars. These should be inspected carefully before being discarded. Many of them might lend themselves to being repaired on the ground by welding, and a great many, if not the majority of them, will lend themselves to reforming.

The practice of cutting track bolts with acetylene torches when relaying rail should be discontinued as this positively destroys the bolts for further use. I am informed that a small amount of oil permits the removal of the nuts from track bolts with very little effort. On extensive jobs, bolting machines may be used. Under ordinary conditions, that might have been an extravagance, but not today. These things should be kept in mind because many normal sources of bolts have been cut off.

Spikes, likewise, should be sorted carefully, and sorted on the job if possible to avoid sending in good spikes to the scrap bin. Those that can be reconditioned on the job should be sorted out to avoid the cost of additional handling and transportation. Speaking of scrap bins—a careful and frequent inspection of them may many times reveal usable material. I suggest that they be kept in mind as a possible source of occasional supply. Furthermore, a bolt threading and cutting machine can be used to advantage in salvaging or reclaiming bolts from large timber jobs, such as platforms and docks, saving in material, as well as in handling and transportation charges.

In the case of welding, which you use so extensively today to keep your frogs, switches and crossings in serviceable condition, please keep constantly in mind that even though the cost of doing this work may frequently be greater than the value of new material, that is not the yardstick today when new material may not be available at any price to keep our transportation system in good condition. Tools of all kinds too, should be watched with greater care than ever. It is extremely difficult, if not impossible, to get certain of them at the present time. All old tools should be returned to some cen-

tral point where they should be reclaimed for reuse by specialists. Even though it may be possible to get only one good tool out of two or three old ones, that is at least accomplishing something. Please adopt all necessary plans to accomplish these things at once. In so doing, we may be able to release material for defense or for other vital work.

Spring Switch Mechanism Causes Freight Derailment

IN THE early morning of March 13, a freight train on the Virginian was derailed at Kumis, Va., while making a facing point movement from the main line over a passing track switch which was equipped with an automatic spring switch mechanism, resulting in the death of the fireman and the injury of the head end brakeman. This accident, according to a report issued by the Interstate Commerce Commission, was caused by failure of the oil buffer of the spring switch mechanism to function properly, the failure being attributed to a torn timing valve screen in the buffer, which permitted solid particles in the oil to clog the timing valve port governing the return of the switch points to their normal position, and thus setting up a condition whereby the right switch point was in position for entry into the siding, while the left switch point was in position for movement over the main track.

The train involved in the derailment was moving eastbound at a speed of approximately 28 m.p.h., the authorized speed for freight trains in this territory. At Kumis, a siding 5,489 ft. long parallels the main track on its south side, and it was at the west end turnout to this siding that the derailment occurred, the specific point being determined as 11 ft. 6 in. from the point of switch.

The switch involved consisted of 130-lb. rail, two points 16 ft. 6 in. in length, 10 switch plates under each point, and 9 rail braces on each side. The wearing points of the switch were of manganese steel, 2 ft. 6 in. in length, and were reinforced by ⅜-in. straps secured by ¾-in. bolts. The points were connected by two switch rods 1 in. thick and 2½ in. wide, spaced 24 in. apart.

The switch stand involved was of the horizontal-throw automatic-spring type, located nine feet south of the center line of the track, and was equipped with two targets and a switch lamp. The switch itself was equipped with springs to provide for automatic return of the points after wheels had trailed through them, and with an oil buffer to prevent the rapid return of the points between successive pairs of moving wheels. When the switch was lined normally, which was for movement on the main track, the springs were under sufficient compression to hold the point against the stock rail.

A distant switch signal was located 3,970 ft. west of the west switch, and was so connected in the switch circuit that when the switch points opened $\frac{5}{16}$ in. or more, it displayed caution. According to timetable instructions, locomotive engineers were permitted to proceed under control when this signal indicated caution, but were required to stop clear of the switch and to ascertain that it was in a safe condition for passage of their trains before proceeding over it.

According to the report of the Commission, inspection of the track following the accident disclosed that each switch point was from 2 to 3 in. from its stock rail, and that there were abrasions on the outside surface of each point and on the inside faces of the engine truck wheels. This latter condition, the report stated, indicated conclusively that the switch points were open sufficiently to permit the engine to move on the two stock rails to a point where the gage between these rails became wide enough to allow the wheels to drop between the rails.

Signal Indication in Dispute

Whether the distant switch signal indicated proceed or caution at the time of the accident was a matter of dispute, the engineman contending that he received a clear signal, while the front brakeman stated that the signal was at the caution position. However, after the accident, the distant switch signal was tested thoroughly and operated as intended. There was no condition disclosed that would cause this signal to display proceed when the switch point was ¼ in. or more from the stock rail. From these tests and the statement of the front brakeman, the Commission concluded that "It appears probable that the signal displayed caution for the train involved."

The last train to pass the point involved prior to Extra 101 was a westbound freight train that moved from the siding through the west switch, and thence to the main track, 1 hr. and 27 min. before the accident occurred. Apparently, after the rear of the westbound train reached the main track, the switch points started to return to their normal positions, but stopped midway between the closed and opened positions and remained at this midway point until the derailment occurred. No object was found that might have fallen between the switch point and the stock rail, and the sliding plates of the switch were well lubricated and free of grit.

Torn Oil Screen

The oil buffer provided to prevent the rapid return of the switch points to their normal position contained a torn timing-valve screen. When the oil of the buffer was strained following the accident, particles were found that were too large to pass through the port in the timing valve. Undoubtedly, according to the report, the torn screen permitted the particles to block the port so that part of the oil could not pass from one side of the buffer piston to the other; this condition causing the buffer to function improperly, which, in turn, affected the operation of the spring switch points.

The switch involved was installed about three years prior to the time of the accident, and during its period of service the only attention given to it was the addition of oil to the supply in the buffer. If this buffer had been inspected properly at reasonable intervals, the Commission stated, the torn screen and the foreign substance in the oil would, undoubtedly, have been discovered. It also stated that if the buffer had been maintained in proper condition for service, it is probable that the switch would have operated properly and the accident would have been averted.

In the conclusion of the report, it was recommended that the railway submit to the Commission rules for installation, inspection and maintenance of spring switches on its lines.

Making the Most of What You Have

(Continued from page 778)

you have that viewpoint, however? Did you pass along the word that the job at "A" could well wait until the machine was moved in for the one at "B" on the next subdivision? Or did you put out the thought that unless you got the machine this month, even though it required a move of 500 miles and several days delay, you would probably have to "slow order" your whole territory? Unless you can get the district or system viewpoint, you will, in a large sense, prevent making the most of what you have.

And you have certain machines regularly assigned to your territory. Are you giving careful thought to the making of the programs for these machines, designed to get from them the greatest possible output? If you are not, you are not making the most of what you have.

And again I inquire—Are you keeping in close touch with your machines? Do you know that the operators are doing a good job in handling them; that they have been properly instructed as to their lubrication; that they have been provided with the necessary lubricants; and that they are alert to discover any parts that are becoming worn or are showing indications of early failure? And when they advise you that certain parts are needed, do you place orders immediately through the proper channel, and then follow through for as prompt delivery as is consistent with present conditions? Do you see that your machines are checked regularly and frequently by the maintainer, and that adjustments and minor repairs are made to insure their most efficient operation? And do you know that the maintainer also is watchful to discover parts that may fail? Unless you can answer these questions in the affirmative with truth and emphasis, your supervision is falling down and you are not making the most of what you have.

Is There Close Co-operation?

A number of men may be concerned with the operation of a specific machine—the supervising officer, the maintainer, the operator and, perhaps, a foreman. Is there complete and cordial co-operation on the part of all these men? It must be assumed that they all appreciate the importance of keeping the machine at work, whether it be a unit working alone, or one on which the progress of a large gang depends. If there is lack of co-operation or any tendency toward evading responsibility, these men as a group are not making the most of what they have.

Perhaps your railroad is not in need of any of these corrective measures. Perhaps your purchasing department has withstood the pressure put upon it to buy machines of all makes offered, and, by standardizing, has simplified the handling of repair parts. Perhaps your store is well stocked with parts and lubricants needed to protect the operation of your machines. Perhaps your supervision and your planning are 100 per cent effective and there is complete co-operation on your road in the handling of your machines. If that is so, you are, indeed, making the most of what you have, and you can well say, "You are not talking to me." However, I believe that I know the equipment situation on the railroads of the country well enough to say that if we are to make the most of what we have, many of us must plan better, supervise more intelligently and co-operate with our associates more completely.

We cannot hope that even the doing of all of the things that I have mentioned will relieve all the difficulties that we face, but we can expect confidently that in making the most of what we have, we, in the use of our equipment, will develop a productiveness far greater than we had considered possible heretofore.

The author, President of the New York Central System

ENTHUSIASM

BY F. E. WILLIAMSON

THE other day a famous psychologist, discussing Army aptitude tests, remarked that I. Q. tests, while helpful, have one important shortcoming: They fail to measure "emotional drive." According to I. Q. tests, or any other known form of measuring ability, a man with a low score is usually rated as fit only for menial jobs, while a high score is considered practically a guarantee of success.

You and I know how misleading that is. I have seen men with low I. Q.'s suddenly "set on fire" by a new idea or a new kind of work. It gives them "emotional drive," which, like live steam, sends them on to great success. And I have seen men with high I. Q.'s fail miserably.

The indispensable ingredient? Psychologists may call it "emotional drive," but you and I know it as "enthusiasm." And no test yet devised can accurately measure enthusiasm, any more than one can measure courage on a yardstick, or beauty in a test tube.

The longer I live, the more certain I am that enthusiasm is the little-recognized secret. The difference in actual skill and ability and intelligence between those who succeed and those who fail is usually neither wide nor striking. But if two men are nearly equally matched, the man who is enthusiastic will find the scales tipped in his favor. And a man of second-rate ability *with enthusiasm* will often outstrip one of first-rate ability *without enthusiasm*.

Primarily, enthusiasm means believing in your work and loving it, be it digging a ditch or directing a great company. To an enthusiastic man, his work is always part play, no matter how hard or demanding it is. Whether a mill whistle or a platinum watch tells him it is five o'clock, he continues to devote his intelligence and imagination to doing better work. If a man be in this frame of mind, he is bound for the stars and success.

Emerson wrote: "Nothing great was ever achieved without enthusiasm." That is more than a well-turned literary phrase; it is a road map to success.

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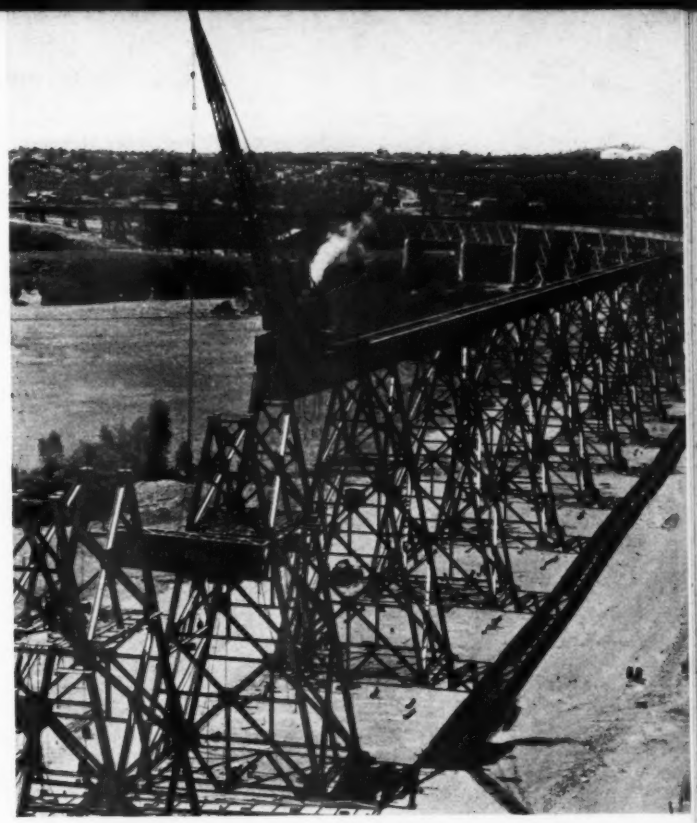
The New Bridge Over the Sacramento River, at Redding, Cal., on the Line Diversion of the Southern Pacific Around Shasta Reservoir in Northern California, One of Eight Major Bridges on this Line. Diversion, Is 4,347 Ft. Long



Hold Three-Day Convention in Chicago on October 14-16, With An Intensive Program Covering Methods, Materials, Equipment, Labor and Protection Against Sabotage

Bridge and Building Officers Gird to Meet New Problems of the Emergency

Following is a running report of the convention activities, including the seven committee reports presented, the opening address by M. J. Gormley, and reference to the constructive exhibit of materials and equipment presented by the Bridge and Building Supply Men's Assn.

CULMINATING 50 years of activity, the American Railway Bridge and Building Association held its forty-eigth* annual convention at the Hotel Stevens, Chicago, on October 14-16, with a highly constructive program and renewed determination among its members to meet their enlarging problems in the most effective manner, and to co-operate with management and the government to the fullest extent in meeting the growing needs of the country for adequate, fast and dependable rail transportation, with maximum safety. The program, designed to meet the most pressing problems of bridge, building and water service men, included seven addresses and an equal number of committee reports, as well as several special features, and was divided into sessions on Labor in a Period of Defense Activity, Buildings for a Streamlined Era, Materials in a Period of National Defense, and Water Service in an Era of Change.

All together, 215 railway men from roads widely scattered over the United States registered their attendance and took part in the meeting, the value of which was enhanced materially by a concurrent exhibit of bridge, building and water service equipment and supplies presented by the Bridge and Building Supply Men's Association in the exhibition hall adjoining the convention room.

Lending support also to the association, four committees of the American Railway Engineering Association and the Executive committee of the American Wood-Preservers' Association, held meetings in Chicago during the convention. The A.R.E.A. committees which met were those on Wood Preservation, Buildings, Wood Bridges and Trestles, and Iron and Steel Structures. All sessions of the convention were presided over by H. M. Church, president of the association, and general supervisor bridges and buildings, Chesapeake & Ohio.

A "Brass Tacks" Program

The convention was opened by M. J. Gormley, executive assistant, Association of American Railroads,

*No annual conventions were held in 1931, '32 and '33.

who, in an inspiring address, described the tasks that lie ahead of the railways, and called upon the members of the association to do their part in carrying out these tasks successfully. Other addresses were made by C. E. Smith, vice-president, purchases and stores, New York, New Haven & Hartford, on What We Are Facing in Materials; by P. O. Ferris, chief engineer, Delaware & Hudson, on Maintaining Forces in a Period of Widespread Demand for Skilled Labor; by A. O. Lagerstrom, architect, Chicago, Milwaukee, St. Paul & Pacific, on Railway Buildings in a Changing Age; by G. A. Haggander, assistant chief engineer, Chicago, Burlington & Quincy, on What We Can Do in the Face of Shortage; and by A. E. Pierce, engineer water supply, Southern, on Modernizing Water Service Facilities to Meet Modern Operating Conditions. Technical reports were presented on The Protection of Bridges and Roadway from River Bank Erosion; The Possibilities of Off-Track Equipment in Bridge Construction and Maintenance; The Maintenance and Repair of Bridge and Building Equipment; Modernizing Small Stations to Meet Present-Day Requirements; Welding in Water Service; Efficient Methods of Transporting Bridge, Building and Water Service Gangs; and Recent Developments in Paint Removal.

Special features of the program included an evening session on Tuesday, commemorating the Golden Anniversary of the association, which was addressed by C. R. Knowles, superintendent of water service, Illinois Central system, and a past-president of the association, on A Half Century's Achievements; motion pictures of the collapse of the Tacoma Narrows bridge; the annual luncheon on Wednesday, with 247 members and guests in attendance, who were addressed by E. P. Coffey, chief of technical laboratory, Federal Bureau of Investigation, Washington, D. C., on The Protection of Railroad Structures Against Sabotage; and the annual banquet of the association on Wednesday night, jointly with the Bridge and Building Supply Men's Association, which was attended by 222 persons. Still another feature of the convention was a "Summing Up" address at the final session on Thursday afternoon, by Armstrong Chinn, chief engineer of the Alton, and a past-president of the association, who, in a comprehensive way, reviewed the many constructive ideas developed during the convention. In his concluding remarks, Mr. Chinn said that among the many things learned at the convention were, that we must keep trains moving; must minimize slow orders; must help prevent a car shortage by unloading materials promptly; must conserve equipment and materials and get the most out of them; must maintain our forces to permit doing our work effectively and efficiently; must protect our properties and equipment from destruction by wear, neglect and sabotage; and must carry on our everyday maintenance operations without interruption, and do it more cheaply than ever before.

H. M. Church
President

As division engineer, district engineer and assistant engineer maintenance of way on the Baltimore & Ohio Southwestern (now a part of Baltimore & Ohio), and, since July, 1929, general supervisor of bridges and buildings on the Chesapeake & Ohio, Mr. Church has had wide experience in all phases of bridge and building construction and maintenance. He has been a member of the association for many years and served as third vice-president and second vice-president prior to his election as president at last year's convention.

R. E. Dove Elected President

In the election of officers for the ensuing year, R. E. Dove, assistant engineer, Chicago, Milwaukee, St. Paul & Pacific, Chicago, and first vice-president of the association, was elected president; F. H. Soothill, chief estimator, Illinois Central system, Chicago, was advanced from second vice-president to first vice-president; G. S. Crites, division engineer, Baltimore & Ohio, Punxsutawney, Pa., was advanced from third vice-president to second vice-president; A. M. Knowles, assistant engineer structures, Erie, Cleveland, Ohio, was advanced from fourth vice-president to third vice-president; and Neal D. Howard, managing editor, *Railway Engineering and Maintenance,* Chicago, was elected fourth vice-president. In addition, A. G. Shaver, consulting engineer, Chicago, was elected secretary, and F. E. Weise, chief clerk to the chief engineer, Chicago, Milwaukee, St. Paul & Pacific, Chicago, was re-elected treasurer.

Three new directors were also elected to serve for two years: J. L. Varker, supervisor bridges and buildings, Delaware & Hudson, Carbondale, Pa.; L. E. Peyser, assistant architect, Southern Pacific, San Francisco, Cal.; and Martin Meyer, supervisor bridges and buildings, Chicago & Western Indiana, Chicago.

The secretary's report showed that, including 50 new members who joined during the year, there are 594 members of the association in good standing. Chicago was selected as the 1942 convention city.

New Subjects

The subjects selected for study by committees during the ensuing year are: Wearing Surfaces for Building Floors, Platforms and Roadways; Rail Fastenings on Bridges, Pits and Turntables; Meeting the Demands for Increased Water Supplies in Fast Freight Service; Preventing Accidents Among Bridge and Building Employees; The Repair of Steel Bridges; The Conservation of Bridge, Building and Water Service Materials; Piles and Pile Driving; and The Cleaning of Masonry Buildings.

In following columns are presented all of the committee reports, with abstracts of the discussions which followed, as well as abstracts of the addresses by President Church and Messrs. Gormley, Knowles and Lagerstrom and of greetings extended by officers of the American Railway Engineering Association, the Roadmasters' Association, and the Bridge and Building Supply Men's Association. The addresses by Messrs. Smith, Coffey, Ferris, Pierce and Haggander will appear in later issues.

Greetings Extended

Greetings from the American Railway Engineering Association were extended to the convention by H. R. Clarke, engineer maintenance of way of the Chicago, Burlington & Quincy, and second vice-president of that as-

sociation, speaking for F. L. C. Bond, vice-president and general manager of the Central region of the Canadian National, and president of the association, who was unable to be in attendance. In his remarks, Mr. Clarke referred to the greater difficulties confronting bridge and building men today, as compared with a year ago, but said that it appeared likely that the days ahead would bring other and still more difficult problems, not alone for bridge and building men, but for the railway industry as a whole—problems which, he said, "must be solved." That bridge and building men have the ability to measure up to any increased responsibilities that may be thrust upon them, he was certain. "Bridge and building men are not scared," he said. "They have done a splendid job in the past, and are ready to do it again. They know what the problems are, and, being forewarned, are forearmed."

Speaking for the Roadmasters' Association, A. B. Hillman, its president, and engineer maintenance of way, Chicago & Western Indiana—Belt Railway of Chicago, brought greetings, and called for the closest co-operation between members of the two associations in the interest of solving the increasingly acute problems that lie ahead. He pointed out that with such co-operation, "there is not the slightest doubt but that the men in the maintenance of way and structures departments will rise to the emergency as they always have in the past." After referring to the accomplishment of bridge and building and roadway men during the lean years of the depression, with limited manpower and materials, and in spite of increased train speeds, he said:

"Now again we are being called upon to assist the operating department to transport, promptly and efficiently, the materials needed in the national defense program. This time, to keep cars rolling, our work must be carried on without hindrance to that department. There must be no interference with the operation of trains. We must do our work with a minimum amount of power and a minimum number of cars—and the cars that we do use, must be kept moving."

C. C. Rausch, representative, Dearborn Chemical Company, and president of the Bridge and Building Supply Men's Association, extended greetings from that association, and urged those present to profit to the fullest extent from the exhibit being held in conjunction with the convention. "The representatives of those companies exhibiting are here to help

R. E. Dove
First Vice-President

F. H. Soothill
Second Vice-President

G. S. Crites
Third Vice-President

A. M. Knowles
Fourth Vice-President

F. O. Whiteman
Secretary

Bridge and Building Association

Officers 1940-41

H. M. Church, president, general supervisor bridges and buildings, C. & O., Richmond, Va.

R. E. Dove, first vice-president, assistant engineer, C. M. St. P. & P., Chicago.

F. H. Soothill, second vice-president, chief estimator, I. C., Chicago.

G. S. Crites, third vice-president, division engineer, B. & O., Punxsutawney, Pa.

A. M. Knowles, fourth vice-president, assistant engineer structures, Erie, Cleveland, Ohio.

F. O. Whiteman, secretary, Chicago.

F. E. Weise, treasurer, chief clerk to chief engineer, C. M. St. P. & P., Chicago.

Executive Committee

A. E. Bechtelheimer, past president, bridge engineer, C. & N. W., Chicago.

(Term Expires October, 1941)

N. D. Howard, managing editor, *Railway Engineering and Maintenance*, Chicago.

L. G. Byrd, supervisor bridges and buildings, M. P., Poplar Bluffs, Mo.

K. L. Miner, supervisor bridges and buildings, N. Y. C., Albany, N. Y.

(Term Expires October, 1942)

R. E. Caudle, assistant engineer structures, M. P., Houston, Tex.

I. A. Moore, trainmaster, C. & E. I., Salem, Ill.

W. A. Sweet, general foreman bridges and buildings, A. T. & S. F., Newton, Kan.

F. E. Weise
Treasurer

you solve your problems," he said, "and are anxious to answer any questions that you may wish to ask.'

Celebrate Golden Anniversary

Appearing on the Golden Anniversary program on Tuesday night, at which many lantern slides of "old timers" and early convention groups were shown, C. R. Knowles, superintendent of water service of the Illinois Central system, and president of the association in 1922, spoke, in part, as follows:

"The American Railway Bridge and Building Association was 50 years old on September 25, and, with the exception of the Roadmasters' Association, is the oldest railway maintenance of way organization in existence. The founders of our association were imbued with the belief that there was a need for an organization of this kind, where they could meet and exchange ideas borne of their combined knowledge and experience, and through this communion of ideas, help to insure the advancement of knowledge pertaining to the design and construction of railway bridges, buildings and other structures.

"The result of the work of our association during the last 50 years indicates that it was founded upon sound principles. In looking back over its Proceedings, which record its work from year to year, one is deeply impressed with the immense amount of work that has been accomplished.

The various reports as published year by year cover a wide field dealing with all branches of bridge, building and water service work, and are accepted generally as text books of concise and practical information pertaining to these subjects. It is necessary to follow the work of the association throughout its 50 years of life in order to appreciate the progress that has been made in the branches of railroad service represented by this organization.

"Contact of the association with manufacturers in the field has always been pleasant and harmonious. This relationship, with its exchange of ideas between members of our association and manufacturers has gone far toward the development and application of materials, methods and up-to-date equipment used in bridge, building and water service work."

There has been remarkable advancement in the design and construction of railway structures during the last half century, and in this our association has had no small part.

"To quote from a past-president of the association: 'Through all the transformation, all the evolution, our association remains today unchanged in the fundamental objects and principles for which it has always stood. Any institution which can prevail through so long a period of incessant and radical change, compels more than passing notice. It must be worthwhile. The high purpose and noble ambition of the individual in duty well done can alone render enduring any composite organization such as this, and thus has the association grown and prospered. Well may we be proud of the enviable position our association occupies.'

"Although we can well be proud of the work of our association and the position it occupies in the railway field today, our work is not finished; it is hardly begun. Although the progress and development during our 50 years of existence have been remarkable, they are but little as compared with what we may expect in the future. The coming years promise even more progress, with which we must keep pace if we are to keep up with the procession of time. We have little to fear, however, if we will follow the same spirit of loyalty and devotion to duty that have been the outstanding characteristics of the membership of this association throughout the last 50 years."

President Church's Address

In his presidential address, President Church reviewed the changing problems that have faced bridge, building and water service men over the years, and the increased demands now being imposed upon them by changes in operating methods and the huge defense efforts of the country. He also called for closer cooperation between employees and management, and for an expansion of the benefits of the association through increased membership and more intensive participtaion in its work.

Speaking of changed practices in bridge and building work, and of present-day demands, Mr. Church said, in part, as follows:

"Bridge renewals and repairs must be programmed and scheduled to provide structures of a more permanent character. Untreated timber must give way to treated timber. Buildings used by the traveling public must be reconditioned and improved through the use of new materials and equipment to provide an inviting atmosphere.

"Recent typical building improvements are characterized by the use of many new materials, such as glass blocks, stainless steel, aluminum, chromium, and rubber in many colorful combinations. Asphaltum and asbestos combination wallboards and plywood are also being used to a greater extent. Creosoted and salt-treated gum wood (permitting the probable increased use of the less durable hardwoods), creosoted wood blocks, steel plates, and many concrete and bituminous products, possess many advantages. There is also a trend toward modern doors of generous width, that will facilitate the use of tractors, motor trucks and trailers.

"As in the case of buildings, marked advance has been made in bridge construction and maintenance, involving new materials, power tools and machines. Tubular piles for foundations, aside from their other advantages, have expedited the use of off-track equipment. Steel plates of the 'H'-section type, and reinforced concrete piles, have brought about new practices in the design of piers and abutments. Flat-slab bridge decks and solid plate floors on steel spans, without ballast, are increasing in use. Modern fuel and water stations have outstanding economic advantages.

"The progress that has been made in water stations is exemplified in the water station of modern design, the introduction of automatic pumping facilities, and the great strides that have been made in water treatment. At a recent meeting, the Master Boiler Makers' Association reported that 262,500,000 lb. of scale-forming solids are being removed annually from locomotive boiler water supplies through treatment, resulting in a reduction of approximately $35,-125,000 annually in the cost of operating and maintaining locomotives. All of these improvements have been made, and must continue to be made, in the face of active competition, higher costs of materials and labor, and lower freight and passenger rates."

At another point in his address, Mr. Church emphasized the importance of the supervisor and foreman, and their responsibility in seeing that their men understand and co-operate in carrying out the contractural obligations between management and employees. "They are in direct contact with the workman," he said, "and on them rests the responsibility of seeing that the rules and working conditions are maintained and applied in a fair and reasonable manner. I invite your attention to the thought that when supervisors and workers understand what management is doing, and the reason for its policies, the reward is a degree of co-operation that cannot be obtained to the same extent by any other means." Continuing, he said, "The results of proper co-operation between labor and management are increased indus-

trial efficiency, lower costs, and a general trend toward a better economic system in which it is possible for both employees and management to enjoy a sense of satisfaction in their jobs."

At another point in his address, speaking of the need for the conservation of equipment and materials in the face of the shortages that are developing as the result of our national emergency, Mr. Church offered the following suggestions: Make the most of what you have; conserve man-hours; employ the most economical methods to do your work; take advantage of modern materials available; secure the greatest output from your present equipment and tools; increase the output of your men per man-hour; and withal, do not overlook the fact that under the increased speed of traffic prevailing, safety must have first consideration.

M. J. Gormley Appraises the Tasks Ahead, in Opening Address

OPENING the convention, M. J. Gormley, executive assistant, Association of American Railroads, speaking on The Tasks That Lie Ahead of Us, decried the statements of "soothsayers" in Washington as to the inability of the railways to handle the traffic during the present emergency, cited the record of the railways to date and the statements of members of the Interstate Commerce Commission to the contrary, and predicted anew that the railways will not fail to meet the requirements for rail transportation in 1942, unless they are prevented by governmental agencies from obtaining the necessary materials for the construction of new equipment and for the repair of equipment already on hand. Citing examples of statements of those who have predicted the falure of the railways to meet the demands, Mr. Gormley said:

M. J. Gormley

"I see no particular objection to statements of this character being made, providing shippers, the people most concerned, will keep in mind the source or basis upon which they are made, and how much consideration they should be given in the handling of their own business. Unless this is done, they are liable to create hysteria on the part of the shipping public about a possible shortage of transportation, which, in turn might cause the shipment of more traffic than can be unloaded promptly at destination, thereby creating a so-called bottleneck in transportation by the forced use of cars for storage purposes—which is the only way a bottleneck can be created."

For a statement of what has actually been accomplished by the railways in spite of the warnings by alarmists, Mr. Gormley quoted from a recent address by Joseph B. Eastman, chairman of the I.C.C. as follows:

"The railroads have functioned admirably and they have had wonderful co-operation from the shippers of the country. The air has been full of dire forebodings of a breakdown of railroad service, but thus far the prophets of disaster have been pleasantly disappointed, and I think it fair to say that the railroads have performed as well as any part of the national defense mechanism."

"Certainly," Mr. Gormley commented, "Commissioner Eastman could not be accused of overstating the case when he says the railroads have performed as well as any part of the national defense mechanism."

Turning to what is ahead for the railways in the way of traffic, he said, in part, as follows:

"The Shippers Advisory Boards make quarterly estimates of the cars they expect to ship. For the last quarter of this year their estimate is 11.8 per cent above the same quarter of 1940. Assuming that the Advisory Boards' estimate for the loading in this quarter will prove to be correct, then the loadings for the year 1941 will be approximately 42,184,000 cars. The estimate of the Research bureau of the Office of Production Management is that 46,400,000 cars will be loaded this year. If the Advisory Boards' estimates are correct, then the OPM's estimate will prove to have been 10 per cent too high, or approximately 4,216,000 cars more than will actually be loaded. On the other hand, the estimate made by the Car Service division of the Association of American Railroads will, on this same basis, prove to be 1,285,000 carloads, or 3 per cent, less than the actual carloadings.

"In trying to get some idea of what the task ahead of us really is, let us take the estimate of OPM's Research bureau for 1942. This estimate shows that carloadings will exceed 1941 by 10 per cent. If we apply this 10 per cent increase to the actual loadings for 1941 as now estimated by the Advisory Boards, then the estimate of the carloadings for 1942 will be 46,400,000 carloads, instead of 51,100,000 as shown by the OPM Research Bureau's figures. In other words, on the basis of the information available today, and using the figures that I have referred to, we will load 4,216,000 more cars than we did in 1941. As a matter of fact, however, no one knows whether the present rate of increase in traffic will continue. At the same time, no one knows how much the production for defense will curtail other traffic.

"In this connection, it should be understood that the Research bureau of the OPM did not estimate the less-than-carload traffic—that was estimated by ourselves and added to their figures for carload traffic in order to give the complete picture."

"In September, 1939, less than three weeks after the war broke out in Europe, the rilroads told the public that rail transportation would be adequate for the traffic then in prospect, and that any additional equipment which might be needed as demands developed, would be acquired. They have made good on this statement to date, and they will continue to make good unless they are prevented by the government from obtaining the necessary materials for the repair of their present equipment, and for the construction of the new equipment needed.

"According to the latest figures, the railroads, during 1941, to and including September 30, have put 55,658 cars and 425 locomotives in service. In addition, they now have on order 88,829 cars and 671 locomotives."

As an indication whether these and other steps taken by the railways will

be adequate, Mr. Gormley, in closing, quoted from an address by Commissioner J. M. Johnson of the Interstate Commerce Commission, as follows:

"With a fair break in priorities for new cars, the railroads will be able to handle whatever volume of traffic there will be next June, when the load may be expected to be heavy."

Maintenance and Repair of Bridge and Building Equipment

Report of Committee

Martin Meyer
Chairman

THIS subject is a very live one today. The mechanization of bridge and building gangs is of comparatively recent origin, but it has expanded so rapidly that the proper care of equipment has become of major importance. It has been handled on the railroads, for the most part, like "Topsy"—it "just growed"; and bridge and building officers are aware of the resultant inconsistencies and abnormal development that exist in this regard, as they always are of anything that "just grows."

That there is a real necessity for the effective and efficient maintenance of such equipment is beyond question. The investment in equipment must earn a profit, and this profit must not be lost by inefficient machines, costly delays to large gangs, accident and injury expenses due to machine failure, unnecessarily large expenditures for repairs, or shortened service life due to improper care. An idle machine is a frozen asset and a broken-down machine is an actual liability. We all know what it means to have a machine fail, and to have to resort to hand labor and obsolete methods to complete a job—the added cost, the additional time required, and, in some cases, the impossibility of completing the job until the machine is repaired or replaced with a similar unit. This is extremely serious when it interferes with the movement of trains.

Systems Vary

Many roads have made extensive studies and have established expertly engineered systems to acquire the high standard of machine maintenance necessary for dependable performance. These systems vary greatly in their organization and personnel, and in the way they "tie in" with other departments. On some roads all repairs to all types of equipment are made by the mechanical department. On others, only extensive repairs to heavy work equipment are handled by that department, and repairs to other types of machines and tools are made by other departments.

A few roads have organized special departments exclusively for this purpose. The activities of these special departments are under the direction of the mechanical department on some roads, while on others they come under the engineering department. Such a special organization, directed by the maintenance engineer and having a personnel specially trained for the work it has to do is, without doubt, the ideal. It requires considerable investment for tooling and housing, but, on large roads with many items of equipment (sometimes numbering many thousands), such an organization is justified. It offers many advantages. Its primary purpose is the maintenance of work equipment, and it is only reasonable to expect that the results secured will be better than those obtained in a department in which such work is secondary. Its men are more familiar with the design and construction of the machines they work on; in fact they are, or become, experts in its repair. Furthermore, they are in closer contact with the equipment and, therefore, are in a position to know how it is used and what is expected of it. The work of such a special organization can be programmed to the best advantage of the department using the equipment.

Where the size of the road or the number of units to be maintained is not large enough to justify such a special department, the next best arrangement is for the mechanical department to perform the heavier repairs and complete overhauling work, thus eliminating the expense of the larger items of tooling and housing. This has the decided disadvantage of dividing the responsibility for the proper maintenance of the equipment. Furthermore, with the mechanical department, the work is secondary in importance to the maintenance of operating equipment. Most small roads have found that, from the standpoint of investment and cost, it is necessarily best to have the shop repair of their equipment handled by the mechanical department.

Shop repairs are, for the most part, handled on a system basis, whether they are done by the mechanical department or by a separate organization. This avoids the duplication of tooling and housing at several locations, and affords better control of operations because the repairs are centralized. In addition, cost records can be kept with greater accuracy, and the personnel can be kept more fully occupied and brought to a higher degree of efficiency. The great distances that equipment must be shipped on the longer roads under such a system shop basis, however, with the loss of time and the expense incurred, have prompted some roads to establish several shops, strategically located. Under such conditions, duplication of tooling and housing can be justified. In fact, in the case of the larger roads having a large amount of equipment, some argument can be found for handling its repair even on a division basis.

Programming Repairs

Considerable effort is being directed toward programming equipment repairs, but it seems quite evident that an absolutely rigid program cannot be adhered to. Identical machines will not require identical repairs in an identical length of time; and it does not seem practical, therefore, to program repairs beyond that of seasonal machines that can be inspected, and the repairs found necessary made during

the off-season when the machines are not being used. There is some danger of over-maintaining machines that are sent in periodically or on a definite program, because, unless supervision is keen, there might be a tendency to completely overhaul them when their condition doesn't warrant the expense.

From a practical and economical standpoint, there should be no necessity for sending a machine into the shop so long as it is performing satisfactorily. It would seem better to direct more effort in the direction of periodic inspections of all machines, rather than toward programming repairs; and men trained to make these inspections should be made available on roads having many and complicated machines, because the average supervisor is too occupied with maintaining the railroad to have the time necessary to make thorough and expert inspections. The inspection should not be left entirely to the operators, because while most of them may be conscientious in this respect, many are not. Furthermore, it happens quite frequently that an operator will not report a defect if it is due to his own neglect, in order to avoid discipline; he may not want to bother with making repairs of defective conditions found; he has a false idea of economy; or he lacks the knowledge of what the correct condition should be.

There are, of course, some repairs that might be made more advantageously by the manufacturer or by an "outside" concern specializing in certain operations. This, of course, depends entirely on how completely the particular road is equipped with the necessary tools and skilled mechanics for doing the work. The average road is not in the best position to recondition pneumatic tools by building up worn pistons or reboring; to rewind and bake out the armatures and fields of electrical tools and generators; to recondition the fuel pumps and injectors of Diesel engines; or to set up and aline parts for which expensive jigs are necessary.

Field Repairs

On roads on which a special equipment maintenance organization has been established, it is ideal to have field repairs made by mechanics who are a part of such a special organization. These men should be assigned to a particular division or territory which they can cover adequately. In the event that there is a concentration of machines at the site of a large job, these men can be assigned accordingly.

Roads that do not have a special machine maintenance organization will probably find that the most efficient, prompt and convenient way to effect field repairs is to have them made by members of the bridge and building department itself, because these men are already on the job, know all the surrounding conditions, and are under the direction of the engineer or supervisor in charge of the work. The talent for mechanical work that can be found in any group of bridge and building men is generally quite surprising, and it will usually be found that there is someone in the gang, or readily available, who can make repairs that are usually thought of as being incapable of accomplishment in the field. A possible refinement of this arrangement might be had in a combination of interest with the local roundhouse or other mechanical department facility, thus making available its talent and tools for repairs that may be a bit too much for the bridge and building department forces to handle alone. Most roads require machine operators to make minor repairs, adjustments and replacements of small parts. In practically every case, they are held solely responsible for the safe and dependable condition of their machines. They are generally furnished with a manual on the care and repair of their machines and are required to be familiar with it. This assists them in locating trouble and ordering parts, and in accomplishing field repairs on which they might otherwise have to call for expert assistance.

Need Adequate Records

The information collected by your committee indicates great laxity in the matter of keeping records of repairs. Most of us are handicapped by a lack of adequate clerical force, a situation which has prevailed throughout and since the depression, and we have been unable to gather and keep the statistics that it would be desirable and valuable to have. It is difficult to judge when a machine is costing more for repairs than is justifiable, as compared with the cost of its replacement, unless cost records are kept.

Of course, we had to be content with what we had during the depression, and most of us found it easier to worry along and keep repairing our "old relics" than to try to convince our managements that we should have new machines. But if we had had adequate cost records to show that our arguments were sound, there is no progressive management that would have attempted to "shout down" such facts. An adequate record should be kept of the repairs necessary and their cost, so that a basis can be had for exercising good judgment in maintaining our old equipment, in purchasing new equipment, and in fitting machines of proper size and power to the jobs they are expected to do. Under the artificial conditions of the immediate present, which we hope are temporary, it is, of course, necessary to continue to maintain the machines we have, because new ones are not readily procurable.

Most roads, apparently, do not have a monthly equipment report other than that required by the auditing department; neither do they have a daily performance report, other than the meager information shown on the daily time report. Such information as would be available on proper daily and monthly reports is valuable, and even necessary in the case of major pieces of equipment, and if the record system is properly designed, it should not be costly to maintain. There is a trend toward keeping such records.

Lubrication Important

The factor, above all other factors, in getting out of a machine everything that was built into it, is the servicing and general care that is given to it. Careless neglect of a machine is inexcusable; it curtails its life, makes the necessity for repairs frequent and costly, and robs it of its dependability.

First in importance in the servicing of a machine is the matter of proper lubrication. Most manufacturers realize the importance of this so fully that they spend much time, effort and

General View of the Well-Equipped System Work Equipment Maintenance Shop on the New Haven

money to design the lubricating systems of their equipment properly and to determine the best kind, quality and grade of lubricant for each particular machine. If, after much research and many tests, the manufacturer makes specific recommendations on what lubricant to use, it is only fair to him and to the machine, and, incidentally, to yourself and your railroad, that these recommendations be adhered to strictly.

The petroleum industry has made marked advances in the scientific development of lubricants. Oil is no longer just oil, and just because a thing is "slippery" doesn't mean necessarily that it is lubricated properly. The importance of this matter of using proper kinds and grades of lubricants cannot be stressed too much in this day of modern machinery in which clearances are reduced to the smallest fraction of a thousandth of an inch; machinery, in which tremendous pressures are developed, and in which extremely high temperatures are reached. The Diesel engine would be a failure if it were lubricated with an oil having a flash-point below the high temperatures at which it must operate. The hydraulic hoist on a dump truck would be only a source of trouble if its cylinder was filled with ordinary oil, instead of a completely dehydrated oil. Pneumatic tools can be a great disappointment if improperly lubricated with a gummy oil that sticks the pistons, rotors and valves so tightly that they can be freed only by taking the tool completely apart.

A little matter of big importance, after the proper lubricant is purchased, is the way in which it is stored and distributed. One will find his purpose somewhat defeated if his lubricants are stored and shipped in dirty containers, or containers that have been used for something else, or that are not closed properly to prevent contamination. It was all right in the old days for the country store-keeper to jab a potato over the spout of your mother's "coal-oil" can, but this will hardly do today. If the facts could be known, improper containers for lubricants and fuel will, without doubt, be found to be the source of many failures of machines to operate satisfactorily, or perhaps, at all.

Lubrication should be *adequate*. Adequate does not mean that it should be applied so profusely that it runs out of bearings and gets on clutches and brakes. It means that at no time should dry metal be permitted to move over dry metal. It means that a film of oil or grease should always be maintained between moving parts to take the wear and absorb the pressure. In an internal combustion engine, it means that the proper quantity should always be kept in the crankcase. Many persons do not know about one phase of the importance of keeping crankcase oil at the proper level. The oil, in addition to keeping the engine lubricated, also serves to carry heat away from the wrist pins, connecting-rods, bearings and valves. If the full quantity is not in the crankcase, as much heat will not be dissipated, and the bearings, for instance, might expand to a point where all clearance is taken up so that no oil can get between moving surfaces, and proper lubrication is lost.

Good Housekeeping

Equipment should be kept clean. Good housekeeping pays dividends with machinery as it does with everything else. Parts subject to corrosion

Provision Must Be Made to Insure that all Equipment Gets the Proper Attention and Care on the Job

should be kept painted or otherwise protected to prevent deterioration. Equipment, wherever possible, should be housed properly when not in use. Farm machinery manufacturers tell us that one of their greatest problems, when farmers began to mechanize, was to educate them to provide housing for their machinery and not let it stand out in the field after plowing, cultivating or harvesting until needed again the next year, only to find it in bad condition from attack by the elements. How about our railroads? Damage costing the railroads a tidy sum of money each year is done by this same kind of neglect of equipment.

On most railroads, it is the duty of the operator to see that his machine receives the proper servicing and care. This usually results in flat failure with the smaller items of equipment not handled by the same operator at all times. Machines such as small concrete mixers, concrete breakers, and tools of various kinds that are sent out from headquarters, as required, and interchanged between gangs, are almost certain not to receive proper care unless someone at headquarters is delegated to clean them up and lubricate them properly every time they come in. Each gang should have some one man delegated to take care of these small pieces of equipment while they are in use in the field.

In spite of its importance, it seems that very few railroads keep records of any kind of the servicing done on specific machines; perhaps for the same reasons that they do not keep complete records on the repairs made. Likewise, very few roads have established any method of checking whether their machines are being serviced properly. Flagrant cases of neglect or improper care will, of course, be noticed when the machine is sent in for repairs, but otherwise we must rely upon our operators being conscientious, and upon our foremen and supervisors being watchful and alert to notice any evidence of failure in this respect. This should be one of the first things to check where a system of periodic inspection has been established. This matter of the proper care of equipment assumes gigantic importance in the face of our current national emergency, because of the difficulty, and possible impossibility, of being able to purchase replacement units, or even repair parts.

Supplies

Care must be exercised in the matter of supplies of repair parts and accessories to insure against acquiring large inventories representing considerable investment, and yet have those things available that are needed urgently when failure occurs. If a good system of records is kept, it will reveal quite accurately what parts should be stocked and the quantity that is likely to be required in a given period of time. The larger and more expensive items, such as engine blocks and crankshafts, do not fail without warning unless a machine is allowed to freeze up or run without oil, or is abused in some manner. Therefore, with adequate inspection and some foresight, these parts can be obtained from the manufacturer promptly enough to make it unnecessary to stock them on the railroad. Much valuable advice can be secured from the manufacturer on which parts are apt to play out, and these can be stocked accordingly.

If there are many units of the same model on a road, considerable saving

might be realized by having a rather complete line of parts on hand; the new ones to be installed and the old ones reconditioned and returned to stock for future use, much the same as the exchange system developed in the automobile industry for the lower-priced popular cars. Stocks of repair parts are kept at a central location on most railroads, usually by the stores department, to avoid duplication of inventories and to afford better control. In the case of accessories and supplies, this also has a decided advantage in that better prices can be obtained by quantity buying.

The practice of holding to an absolute minimum supplies of spare parts and accessories kept by field crews is practically universal. Only such minor parts as breaker points, spark plugs and fan belts are supplied to field crews. This must be done, because if each crew is furnished anything and everything in any quantity, large sums of money would soon be tied up—dead money, for the most part, earning no return. A few roads report that they do not keep any spare parts with field crews because of the abuse that can so easily creep in. Cases are known where complete replacements have been accomplished by ordering a few parts at a time. In other words, if the cost of all the parts were totalled, it would be found to exceed by several times the outright purchase price of a new, up-to-date piece of equipment.

Much can be done toward reducing the variety of parts that would otherwise have to be stocked, if the practice is established of requiring the operator, or those using the machine at the time of failure, to telephone or telegraph in a list of the parts that will be required. The parts can then be secured from the manufacturer or his local outlet while the machine is in transit to the point of repair with little, if any, more delay to the machine than would be experienced if the parts were kept constantly on hand. This practice is in use on some roads with very satisfactory results. It is recognized that this practice may not work out so well today because of the difficulty of securing deliveries. Therefore, "for the duration," your committee recommends reluctantly that as full and complete stocks as possible be maintained—judgment, and not panic, dictating the quantities.

There is also the problem of what to do with any repair parts remaining in stock after the machine for which they were intended has outlived its usefulness, and has been scrapped or otherwise disposed of. They certainly should not be allowed to remain in stock, as, no doubt, is frequently the case. They should also be scrapped or otherwise disposed of, and when the last machine of a particular type is retired, the storekeeper should be informed accordingly and instructed to dispose of any parts that are usable only on such units.

Conclusions

The most apparent fact running through all the foregoing is that no particular system of maintaining work equipment can be designed that will fit all of the requirements of all railroads. The physical characteristics of a particular railroad—whether it is large or small; serves an extensive or compact territory; has many or comparatively few units to maintain; its location with regard to large industrial centers; and a never-ending list of other conditions—all influence what system is best for its particular needs. Even when a definite system has been established, it must be extremely flexible so that, in case of the sudden failure of a machine, every advantage can be taken of local conditions to accomplish its repair and restoration to service most expeditiously. For instance, if a machine should break down while working on a turntable job, where a complete machine shop capable of making the repairs is located, it would be nothing short of folly to send the machine a couple hundred miles away to a central repair shop just because that particular shop had been designated as the equipment repair shop. No two cases of failure are alike, and no concrete plan will replace "using the old noodle" when failure occurs.

Your committee feels, however, that it can make certain recommendations. First, that you study your particular requirements and weed out the inconsistencies and abnormalties that exist in your present system, if it "just growed." Socialize "Topsy" and give her some cultural refinements.

The following is an average pattern for the average railroad, to be varied, of course, to fit any conditions peculiar to a specific road.

Shop repairs to work equipment should be made in a shop or shops independent of those used also for maintaining operating department equipment. This should include all repairs not coming under MCB rules, which repairs are probably most properly made in the regular mechanical department shops.

The activities of the work equipment shop should be directed by the engineer maintenance of way or other chief maintenance officers. Every effort should be made to avoid dividing the responsibility for the proper maintenance of equipment.

Field repairs should be made by persons employed in the bridge and building department and supervised by bridge and building officers. The field force should be complete enough to be efficient. Good work in the field will prevent the necessity of many extensive and expensive repair jobs in the shop.

A complete assortment of the required tools should be provided. There are many tools designed especially for working on internal combustion engines, which, if adopted, will increase the output materially. One would hardly expect a gas-engine mechanic to get as good results with a monkey wrench as could be obtained with a well-designed set of socket wrenches. There are many small power-driven units designed for particular operations, such as valve refacers and grinders, cylinder reborers, connecting-rod rebabbetting jigs and carbon cleaning tools, that should be in every shop having a number of gasoline engines to maintain. A screw-cutting lathe, drill press and blacksmith and welding equipment should also be provided. Just how extensive the shop equipment should be depends, again, on the size of the railroad and the number and types of machines and tools to be maintained. An overhead hoist of some description is a necessary adjunct to any shop that handles the heavier units of work equipment.

The shop equipment should be housed in a suitable building with plenty of working area. An old coach or car body will hardly do. At the present stage of mechanization, housing should be designed with provision for future expansion and additional shop equipment, because the use of labor-saving machinery in railroad maintenance is bound to increase to a point where facilities adequate today will be insufficient in a short time hence. The acquisition of labor-saving machinery, it must be realized, carries with it the necessity of providing the proper facilities for caring for it.

Sufficient clerical force should be provided to maintain complete performance and cost records.

Close co-operation should be cultivated with the stores department to the end that stocks of repair parts and supplies will be kept adequate, but never excessive.

Good supervision should be provided. Nothing can take the place of the brain of a man who knows his business.

Committee—Martin Meyer (chairman), supv. b. & b., C. & W. I., Chicago; F. E. Taggart (vice-chairman), asst. engr., I. C., Chicago; W. A. Batey, system brdg. insp., U. P., Omaha, Neb.; J. H. Brandt, supv. b. & b., C. & O., Columbus, Ohio; W. W.

Caines, brdg. insp., C. & O., St. Albans, W. Va.; J. J. Clutz, div. engr., Penna., Indianapolis, Ind.; D. W. Converse, asst. engr., A. C. & Y., Akron, Ohio; R. W. Cook, gen. brdg. insp., S. A. L., Norfolk, Va.; H. E. Davis, brdg. insp., N. Y. C., Chicago; R. W. Johnson, asst. engr., C. M. St. P. & P., Chicago; S. H. Knight, supv. work equip., N. P., St. Paul, Minn.; C. Kohler, supv. b. & b., Erie, Cleveland, Ohio; W. K. Manning, gen. brdg. fore., Erie, Cleveland, Ohio; A. Monson, supv. b. & b., N. P., Glendive, Mont.; and A. J. Moore, brdg. insp., M. P., Eunice, La.

Discussion

H. T. Livingston (C.R.I. & P.) stated that while the type of organization responsible for maintaining equipment may vary between roads, the form of this organization is not so important as the assurance that the equipment will be in order and ready for work at all times, except when in the shop for heavy repairs. He agreed that the maintenance of bridge-and-building equipment should be under the jurisdiction of a maintenance officer of such rank that he can co-ordinate all the needs of the equipment. He called attention to the fact that tools sent with machines when they are being transferred from one section of the line to another may be lost through carelessness, and that cases have occurred where failure to check the tools upon receipt of the equipment have been embarrassing because the machines have failed after the track was cut, and tools were not on hand to make immediate repairs.

Approval of the statements in the report concerning lubrication and inspection was voiced by A. Chinn (Alton) who cited a case where section foremen on a certain road had sent in 140 carburetors and ordered new ones to replace them. When this accumulation of old carburetors was discovered, inquiry of the manufacturer disclosed the proper oil to use and the trouble was eliminated. He said that if there had been a system of equipment inspection on this road, the trouble would not have occurred and the purchase of the additional carburetors would not have been made.

Protection of Bridges and Roadway From River Bank Erosion

Report of Committee

THE protection of bridges and roadway from river erosion presents a serious problem to most railroads. As soon as it is determined that a bridge may be endangered or the roadway washed away, the necessary protection should be installed promptly. Otherwise, interruptions to operation may occur, and heavier expense be incurred in both emergency work and in subsequent permanent protection. When the water is at low stage and the weather is clear, an erosion encroachment does not appear nearly so dangerous as when the water is at flood stage in wet weather. The absence of extreme flood flows for a series of years in which rainfall is light, or uniformly distributed, is no assurance that severe floods may not occur. For these reasons, the installation of bank protection should not be deferred where indications are that a bridge or roadway will be under-cut or endangered by a few more floods or continued high water.

Francis Bacon said that "Nature, to be commanded, must be obeyed." So it is with water making up the tiny rivulet or the mighty river. That portion of the water that falls upon the earth's surface and continues its way toward the ocean is what concerns us in this study. We know that it abides by certain quite well-established rules in playing its "war" game, and if we are to control it, we too must know these rules and the characteristics of the earth's surface over which it passes, so that we can shape it to our needs.

A. B. Chapman
Chairman

The flow of water in rivers and streams sets up a continuous change in the channel by erosion and silting. Erosion takes place by solution, suspension and corrasion—that is, by the mechanical action of the movement of the suspended particles along the stream bed. The greater the velocity of the water, the greater is the load it will carry and the greater the load that will be deposited when its velocity is retarded. Some torrential stream beds have been known to have deepened as much as 30 ft. during flood flow, and 10 ft. to 15 ft. is not uncommon. When the flood stage has passed, the stream bed restores itself.

Rivers in flood stages carry staggeringly heavy loads. The San Juan river, by test, was found to carry 75 per cent by volume of silt and sand.

Periodic Inspection

Most roads provide that at regular bridge inspections, stream conditions shall be observed so far as they affect the safety of bridge piers and abutments, the thoroughness depending upon the degree to which the line is exposed to damage. In addition, many roads require that the maintenance forces on the ground observe situations continuously where trouble may occur. In some locations, special inspections or surveys are made after each rise or runoff.

For all locations where erosion is in evidence, special maps should be made and kept up to date. These should indicate the extent and trend of the erosion, and will be most valuable in designing the proper protection. In some cases, it may be desirable to take soundings around each pier and abutment each year, and to keep a tabulated record, so that changes in the stream bed may be noted readily. Inspection by divers at important bridges subject to tidal action or other severe scouring forces may even be desirable.

For the information of field men during storms and high water, it is desirable to mark permanently on abutments, piers and bents the depth to the bottoms of footings and the

average distance down to the points of the piles. This information is essential in connection with soundings made to determine whether a structure is safe for operation.

Instructions for Handling Floods

Roads exposed to storm or flood damage must, of course, have a complete understanding among their maintenance forces as to how to meet flood and high-water emergencies as they occur. This may be covered by general and special rules governing all employees concerned, or by special instructions issued for each occasion by the officers immediately responsible. Most important is the necessity of having the men and their supervisors experienced and trained to take the action necessary. Certain designated supervisory officers must be held responsible for taking charge and organizing the protection and repair work needed.

A few roads carry large stocks of emergency materials, but the more general practice is to hold small stocks in readiness at strategic locations, unless regular stores department stocks or commercial supplies are available quickly enough to meet all ordinary emergencies. The correct number and location of emergency store points are developed by past experience and depend upon the location of regular stores department store houses and the accessibility of commercial supplies. Facilities for quick loading and forwarding are essential.

Among the materials kept in stock for emergency repairs are timber trestle material (enough for 50 to 300 ft. of bridge), ties and timber for cribbing and blocking, track material, stone, gravel, slag, broken concrete, riprap, cinders and other material for filling. In some cases, the material is held loaded on cars. Sandbags, woven wire, tools, dynamite and other supplies are included.

Expedients for Protection Under Flood Conditions

Unexpected high water stages, clogged culverts and bridges, or changed waterway channels may make necessary temporary measures to protect or restore bridges and roadway, although such measures are always more costly, and the efforts put forth are much less effective than would have been had proper protective work been done under normal conditions. Derrick or two-man size riprap is used extensively around piers and at abutments for emergency protection. However, the placing of any such material may decrease the channel cross-section, increase the velocity of flow, and set up eddy currents which may increase the extent of the erosion under and around the loosely-dumped rock.

Bundles of willow or other brush, weighted down with rock or sandbags and thrown into whirlpools in deep water near structures or em-

Control of Erosion by Check Dams on the C. M. St. P. & P., Near Lake City, Minn.; Top—Dams in Place April, 1939; Bottom —Same Dams August, 1941

bankments, are quite effective in breaking up eddy currents that cause scour. If the flow is too rapid, they should be fastened to the bank with wire to hold them in place. Bags filled with sand or earth for temporary emergencies are most effective when used as a paving or revetment on the slopes and tops of embankments. This type of protection prevents the erosion of the embankment material due to currents alongside or over-topping the embankment. It is not very effective in the bed of a stream or where bank cutting has already started.

Logs or trees, with branches intact, lashed to the banks are effective as temporary expedients in shallow streams. In deep streams their buoyancy makes them ineffective against currents below the surface. Brush revetments weighted down with rock are effective protection, but they are difficult to place and to anchor properly during high water. Timber revetments are difficult to sink in water of any depth. Because of their rigidity, the current is likely to get between them and the bank and thus permit its cutting action to continue. Automobile frames and bodies are sometimes used for emergency measures, and have proved satisfactory, but the cost is quite high.

Where flood levels reach the superstructures of bridges, it may be desirable to weigh them down with cars of coal, gravel or any other available material to prevent their being carried off their supports. Unless this expedient seems reasonably likely to be successful, however, it should not be used, because the failure of the loaded bridge may cause greater damage than if the unloaded spans are carried off by the stream. Other expedients used under these circumstances are to hold the spans by means of cables attached to deadmen or to piers, and the driving of wedges between the backwalls and ends of short spans.

Removal of Obstructions

The removal of obstructions in streams will generally be more effective in the smaller streams with high velocity and quick run-off due to narrow valleys, steep slopes, thaws and ice break-up. It is of questionable value in large meandering streams of low gradient and slow current, and those of constantly shifting channels in alluvial soils. Accumulations of logs, brush and other drift material lodged against a structure and obstructing the waterway should be removed before the next period of high water.

Protection of Substructures

Railroads are exposed to attack by stream erosion in two ways: (1) at bridges where footings or pile supports may be endangered by the scouring out of the foundation material by the current, and (2), by the encroachment of the stream upon the roadway and behind the abutments of bridges. The kinds of protection that will be effective in each case depend upon the velocity of the current and the nature of the soil through which the stream flows.

Mountain and upland streams are characterized by steep grades over rock or other hard bottoms, and carry loads of gravel and boulders, and sometimes drift and ice to a greater or less degree. The beds of such streams are thus subjected to severe erosion, from which bridge substructures must be protected. Where bridge piers and abutments are of concrete masonry founded on durable bed rock, the structure is presumably designed for stability against any possible flood flow through the bridge, and no other protection should be needed.

Where foundations are of gravel

or sand, scour around and beneath footings is generally prevented by riprap. Where swift currents are involved, derrick riprap is carefully placed to a smooth surface, with no projecting faces that will cause the rock to be dislodged by the current. Two-man riprap for shallow streams and one-man riprap for very small streams are generally satisfactory, provided the current is not fast enough to move the stones; which may be judged by the size of the boulders actually carried along by the current. Riprap with the voids filled with concrete is effective in preventing its being moved around or washed away, unless it is undercut.

Fascines have been used to hold sandy bottoms under and around piers subject to heavy scour, and to stabilize and hold piers in position where they rest on piles in soft silt bottoms. This construction consists of oblong circular wire cages filled with rock and stiffened with poles. These are laid criss-cross on the river bottom around the piers, and when sand is scoured out by high water, the mats of interlaced fascines sink to the newly exposed bottom. As the flood recedes, silting of the bottom covers the mats, which remain in place to prevent dangerous scour during subsequent floods.

Check Dams

Pile piers in swift streams may be protected effectively by rock-filled timber cribs, or by plank sheathing bolted to the piles, with a small space between planks. Where trouble is caused by large amounts of sand, gravel or boulders, carried by streams with steep gradients, being deposited in openings and over the track, and at other times scouring and undermining foundations, the installation of check dams in the stream bed to reduce its slope to a non-eroding grade, has proved very effective. These dams may be rock-filled timber cribs, concrete or stone laid up in mortar, creosoted timber, or steel sheet piles. The downstream face of the check dams may be vertical, but, if so, ample stone or concrete protection should be placed to guard against undermining.

Large check dams, in general, should be considered as spillways, and shaped to conform to a hydraulic curve to control the velocity of the water at the outfall. If the line of the outfall curve extends somewhat below the level of the lower channel bed to form a pool, the jet action of the water will be broken and it will flow on at a velocity dependent upon the gradient and the roughness of the bed. The depth of the pool should be varied to the volume of water expected.

In some situations, where bridge piers are exposed to considerable drift and ice which might collect on the piers and cause scour, such drift and ice can be intercepted by protections placed upstream from each pier. Where piles can be driven, single piles, pile dolphins, pile cribs filled with rock, steel sheet pile dolfins (rock or concrete filled), or various types of ice breakers can be used. On rocky bottoms, timber cribs filled with rock and anchored to the bank may be necessary.

Bridge foundations must be designed for combinations of circumstances that may produce deep scour at almost any point of the bridge crossing. Concrete and stone piers and abutments are most commonly used; pile piers are common where low cost is desired. Foundations must necessarily be carried to a considerable depth below stream bed; in large and important structures, by sinking caissons or cylinders to rock or other firm strata, often at great expense. For smaller structures, pile foundations must be carried down to secure adequate bearing power as well as to be below possible scour.

Steel pile piers and steel pile foundations are recent developments which offer effective protection against deep scour. Steel piles of "H" section, can be obtained in longer lengths than wood or concrete piles, and can be driven in continuous lengths to still greater depths by splicing on additional sections. Steel sheet piling is frequently driven around piers and abutments to prevent stream bed erosion from undercutting the footings. To insure full protection, sheet piling must be driven well below the ultimate possible scour.

Rip rapping around piers and in front of abutments will leave a considerable part of the stream bed exposed to scour, which may undercut the rip rap. In such cases, adequate protection may require paving the entire width of stream bed under the bridge, and the use of cut-off walls at the upper and lower ends of the paving, carried deep enough to prevent the scour from undercutting. The paving may be of concrete or rip rap laid with a smooth surface, the size of the rip rap depending upon the velocity and carrying power of the stream at flood stage. Concreted rip rap is also used extensively for paving.

Steel and creosoted timber sheet piling provides a most effective construction for cut-off walls. The driven wall has the advantage that the adjacent stream bed, where cutting action is most likely to start, is left undisturbed.

Bank Erosion

Where a stream tends to cut its banks at locations which threaten the track or bridge structures, some form of bank protection becomes necessary. Bank erosion should never be permitted to become so aggravated that emergency measures have to be taken. Protective measures may consist of line changes, channel changes or bank protection and stream guidance. The Santa Fe made extensive line changes and channel changes to overcome flood damage in Cajon pass in California in 1940, and, in connection therewith, placed extensive systems of bank protection, consisting of blanket bank paving of concrete and rip rap, stream deflectors, rip rap rail-crib dikes and steel jetties.

Grouted slag blanket bank protection has been used extensively by the Western Maryland, at a cost of approximately $13.50 per lin. ft. for an average slope width of 27 ft. It was found that the grout extended and proved effective to a depth of 5 ft. below the water surface.

Channel Changes

In regions where streams are located in very stable formations and have well-established channels, changes in the channel are undertaken rarely, and only where careful study of each situation indicates that such a change is justified economically. The more common practice is to maintain and protect existing channels. Damage claims may result from ill-considered channel changes, and the costs of acquiring property or the consent of property owners must be considered.

It is often difficult to force a stream to follow a newly dug channel. At the first rise the channel may become filled and the expenditure wasted. A diversion dike should be built to direct the current into the new channel, confining a sufficient portion of the total flood flow to scour the new channel to capacity.

Cribs and Dikes

Rock-filled cribs afford good protection in streams that have rock or other very hard beds. The timbers should be laid in both directions between successive layers of large stone. The cribs should have a wide base, with sides that slope easily to the top. They should be located at an angle of not more than 45 deg.

Control of High Bank Erosion by Timber Retards and Steel Jetties, Brazoo River, Along the I. G. N., Near Bufkin, Tex.; Left—Soon After Installation in 1936; Right—Two Years Later; Note Deposit of Sand and Growth of Willows

with the bank, and be directed downstream. Cribs at right angles set up whirls against the bank on the downstream side and back-cut the cribs. Cribs should be placed well into the bank. In many cases, rip rap should be placed the full distance between all cribs and for some distance up and down stream from the end cribs. Willows or brush that will grow in the soil beneath the rip rap should be encouraged. If slides occur, the exposed surfaces should be protected promptly. Care should be taken to get the toe rock well placed out on the river bed to keep it from being undercut. This type of protection is equally effective at bridge abutments where the bank tends to cut.

Rock-filled crib dikes have been built with scrap steel rails instead of timber.

In wide, shallow streams through soils that are not too easily eroded, effective protection from erosion during high water can be obtained at comparatively small cost by means of shear fences, which act to reduce the velocity of the current along the bank. This construction consists of well-braced piles, faced with timber, built on a straight line and at an angle of not more than 20 deg. with the bank line. The fence should be placed well into the bank at its upper end, and the bank properly sloped and rip rapped for some distance upstream from the end of the fence. Shear fences should be built of creosoted material; otherwise they are short lived and may be weak or rotten when needed. Rock fill is sometimes placed behind the fences, particularly in deep water.

Another inexpensive and effective type of protection, which acts as a current retard, is that commonly known as steel jetties. It is used extensively in the midwest and southwest. It consists of steel angles placed in inclined directions, braced against each other and laced with wire or cable, and anchored to deadmen in the stream bank. The obstruction afforded by its members as they catch debris in the overflow channel, reduces the velocity of the current and eddy currents sufficiently to cause them to deposit their load of silt, thus building up the stream bed and protecting the adjacent bank.

Revetments

Where the river channel is restricted in width sufficiently to increase the velocity of flood waters, scouring, sometimes to great depths, and rapid erosion of the banks, must be prevented by some form of mattress or revetment work. This will include waterways 30 to 60 ft. in height above the stream bed, with low water stages 5 to 10 ft. above the bed and flood stages at or several feet above the top of the bank. Current velocities at high stage may be as much as 6 to 9 m.p.h.

For such locations, a flexible concrete revetment is considered the most permanent and, incidentally, it is the most expensive type, if installed properly. The bank is sloped 1½ to 1 or 2 to 1. The revetment is cast on the bank and passed over a barge into the water. This type of protection costs from $75 per bank foot on 40-ft. banks, to $150 per bank foot on 60-ft. banks.

Fascine mattress and mud cells, made of either willow brush or low-grade lumber weighted down with rock, have been used extensively with considerable success. They are installed in a manner similar to the concrete revetment described above. Their life is short due to decay of the brush and lumber, and they are quite expensive per foot of bank protected.

Loose rock revetments placed on soft banks in deep rivers are entirely too expensive in first cost, as well as in repairs and replacements, due to undercutting with resulting slides. Slides expose the bank to the action of the current and concentrate the rock out in the bed of the river, permitting the current to get between the rock mounds and the bank and cause erosion. This difficulty applies to all heavier materials, such as scrap automobile bodies, freight car bodies, and locomotive tenders and fire boxes, that may be available for "tumbling" into streams to stop erosion. When the current gets between these bodies and the bank, erosion will continue.

Rip-rap revetments have been used effectively for bank and embankment protection where more than usual attention has been given to the size and durability of the rock, and to methods of anchoring them in position. The rock should be placed with care to form a continuous interlocked blanket three to five feet thick, extending well above high water, with the top edge formed of derrick-sized pieces. The blanket should be keyed into the stream bed to a depth of five feet or more. So important is the anchoring of the blanket that where severe scour is anticipated, the toe should be protected by rail fences or dikes, or by two or more lines of steel jetties. Rail fences or dikes consist of scrap rails driven vertically against the buried toe of the rip-rap blanket, with one or more horizontal lines of rails connected to the vertical rails and anchored into the embankment by cables.

Another typical kind of concrete revetment used recently by the Santa Fe in Arizona consists of a reinforced concrete pavement, cast in place against a carefully-compacted fill. This is carried up to a height of five feet above maximum high water, and is extended deep enough into the waterway channel to prevent its being undermined, in some cases as much as 30 ft. below stream bed. Where severe wave action is expected or where high water is close to the track subgrade, a splash wall curb is placed at the top of the wall to turn waves back into the stream. The slabs are 6 in. thick, reinforced with ½-in. round bars spaced 12 in. on centers both lengthwise and up the slope, and are provided with expansion joints about 60 ft. apart, keyed with dowels.

In streams with soft banks, severe cutting may occur at bends. Protection at such points usually consists of

some form of current retards to cause the deposit of silt in the bend and to direct the current along the inner ends of the retards. Timber groins projecting out into the stream, constructed of piling, with wale boards on the upstream side, are frequently employed. If built of untreated timber, a life of 6 to 10 years may be obtained; if constructed of creosoted timber, a life of 20 to 35 years may be expected. To prevent their being back-cut, it is necessary to protect the bank between the groins and for some distance upstream and downstream.

Current deflectors, either of the steel-jetty type already described, or timber deflectors, or a combination of the two, have proved to be the most economical and efficient protection to stop bank erosion along deep rivers in easily erodible soils. Timber current deflectors are built of a series of three-pile bents, spaced 8 ft. to 12 ft. on centers. The channel-side pile of each bent is battered, with an additional battered pile in line between each bent. The back pile of each bent is also battered. The bents are cross and collar-braced; bracing also extends from the intermediate pile to the back pile of each bent, so that the pressure on one bent or intermediate pile is transferred to the bents on each side. All bracing is bolted, rather than boat-spiked to the piles. Three-inch by eight-inch wale boards are boat-spiked to the channel-side batter piles from the top of the fender to low water level, a space of 2 in. being left between the boards. If the depth of water below the wale boards exceeds five feet, a line of small retards should be laid and anchored along the channel side of the fender to break up the current passing under the boards.

It is the "toe" current, or the movement of water under pressure along the bottom of the bank slope that does the greatest damage in the deeper rivers. The current above the upper half of the bank, being under less pressure, does very little cutting. It does, however, saturate the material for some distance back from the bank, as does also the water in the lower half of the stream. To stop erosion, it is necessary to dissipate the "toe" current and to retard the upper current. It is also necessary to keep the material that caves in from the bank from washing away, and to retard the current sufficiently to deposit silt for some distance out on the bed, to maintain a flat slope on the bank.

Placing Jetties

The lines of fenders or jetties should not be placed at an angle greater than 35 deg. to the bank line, downstream from their beginning points. Furthermore, they should be extended well into the bank. Since fenders are intended to dissipate the "toe" current and deflect it at an easy angle away from the bank, they need not be more than half the height of the bank.

To protect the portion of the bank above the fenders, a flexible type of velocity retards should be laid on the pre-sloped bank, extending well out into the water on the bed of the stream. These retards should be well anchored to dead-men located some distance back from the bank, the various units being cabled together. In addition, two lines of cable should be installed parallel to the bank, one line being run through the units in the water, and the other through the units half way up the bank. This latter anchorage is to keep the units from being rolled or displaced by the current. These retards will dissipate the current next to the bank, catch drift, trash and silt, and protect vegetation and brush, all of which will, in a few years, form a well-stabilized bank. The retard installation should begin well above the upstream fender and continue below the lower fender.

Only creosoted timber should be used for constructing fenders and retards, as untreated timber will seldom last until its purpose, the moving of the channel away from the bank, is fulfilled. The fenders cost $18 to $24 and the retard work $10 to $15 per foot of bank protected, depending upon the height of the bank.

Shallower streams in easily-erodible soils may be controlled easily and quite economically by the use of only the velocity retards, placed in what may be termed current-diversion lines, reaching from the upper to the lower ends of the portion of the bend where erosion is active. Additional units should be installed back of the diversion lines, extending to the top of the bank, where they should be securely anchored to dead-men. The cost of this type of work in rivers with depths less than 30 ft. is from $8 to $14 per foot of bank protected. In depths less than 30 ft., deflecting fenders are seldom necessary, except that one or more short ones may be required in sharp, large-angle bends.

If the railroads today would pay more attention to providing flatter slopes in their cuts and on their newly-placed embankments, and, in many cases, would seed and sod the slopes, as well as plant and encourage fast, easy-growing shrubs or bushes where small washes may occur, nature would take care of many of our problems of roadway embankment disintegration.

Committee—A. B. Chapman (chairman), office engr., C.M.St. & P., Chicago; R. E. Caudle (vice-chairman), asst. engr., M.P., Houston, Tex.; E. M. McCabe (vice-chairman), supv. b. & b., B. & A., Pittsfield, Mass.; G. A. Allen, brdg. insp., C. & O., Clifton Forge, Va.; W. L. Baker, brdg. insp., C. & E. I., Salem, Ill.; M. Bear, estimator, C. & N. W., Chicago; J. E. Bird, b. & b. insp., N.Y.C., Corning, N.Y.; N. Buckley, brdg. insp., M.P., Palestine, Tex.; B. J. Chamberlain, supervisor of scales, C. & E.I., Danville, Ill.; A. R. Harris, asst. bridge engr., C. & N.W., Chicago; J. E. Hogan, asst. div. engr., C. & O., Hinton, W. Va.; N. D. Howard, managing editor, *Railway Engineering and Maintenance*, Chicago; W. G. Kemmerer, asst. engr., Penna., Chicago; A. A. Sirel, engr. draftsman, C. & N. W., Chicago; J. S. Vreeland, associate editor, *Railway Engineering and Maintenance*, Chicago; C. H. Wells, div. engr., C. & N. W., Boone, Ia.; and W. E. White, general foreman b. & b., A.T. & S.F., Chanute, Kansas.

Discussion

The discussion of this report included examples of stream-bed as well as bank erosion and numerous instances were cited of methods used to overcome this trouble. A. M. Knowles (Erie) gave further details of the system of check dams which his company is using with success in streams having considerable fall, and explained that in most cases erosion has been practically stopped by this form of construction. A. R. Harris (C. & N. W.) called attention to the fact that farmers owning land on both sides of the railway sometimes place fences or gates at the mouths of culverts, with the result that the waterways are filled to such an extent as to make a raise of the track necessary. He also advised against the use of any but heavy riprap to protect against bank erosion and suggested that the best results will be obtained where the whole mass is grouted to hold it in place.

A form of construction now in use on his road was described by H. M. Church (C. & O.), in which a trench is excavated parallel to the foot of the slope to be protected and is then filled with heavy riprap to form a footing for other riprap that is placed along the slope of the embankment to prevent erosion. R. E. Caudle (M. P.) suggested that, to be effective, one must get riprap well out into the bed of the stream, that is of sufficient size that it cannot slide away into the current. It had been his experience that retards and jetties give best results in protecting against bank erosion by streams flowing through flat country. He said that in such country the banks are generally easily eroded and it is necessary to slow down the current or to keep it well away from the bank. He cited examples in which revision of alinement had been made

when the track along streams of this character had been threatened, but stated that this is of little use unless the track can be given support on a hillside. He referred to several cases where erosion had again threatened relocated tracks and gave examples of bank protection in the form of jetties which provided ample protection against erosion at much lower cost than line revision. He also explained that jetties deflect and break up the current in such a manner that it ceases to erode the bank and that, in fact, they retain material that flows in and is deposited behind them, in such a way that the bank eventually builds up. He cautioned against their use around bends, saying that they are not very successful in such locations, but are of value only where the current is nearly parallel with the bank.

Stating that the Santa Fe has been following a construction similar to that on the Chesapeake & Ohio, W. A. Sweet (A.T. & S.F.) said that the trench is excavated in the stream with a dragline. It is then filled with heavy riprap which is carried up to and above the high-water line. He said that this form of protection has been entirely successful in territory where banks are easily eroded.

Modernization of Small Stations to Meet Present-Day Requirements

Report of Committee

L. G. Winkelhaus
Chairman

WITHIN recent years, most of the railways of the United States and Canada have greatly improved their passenger equipment, especially with respect to streamlined and Diesel-powered trains. Not only has the equipment itself been improved, but the speed of travel and the comfort of passengers are such that the results have been very gratifying to the railways in the way of improved passenger earnings.

However, the appearance of the facilities at outlying passenger stations has not kept pace with the changes in the train equipment. Very little attention has been accorded such stations towards making them more attractive or comfortable for railway patrons. This is not due to lack of foresight, but rather to the curtailment of expenditures for such work during the last 10 or 15 years.

The new means of transportation provided by motor buses and airplanes are proving very competitive, and have taken a large proportion of the available passenger business from the railways. These competitive transportation agencies have provided attractive and comfortable stations for their patrons—the advertising value of which should not be under-estimated. Therefore, it behooves the railways to "wake-up" and give consideration to the modernization of some of their more important outlying stations to meet present-day needs.

Geographical Location

When preparing studies for the improvement of any station, one must give due consideration to its location, and make the improvement conform with local environments. In mountainous regions, certain innovations can be introduced to fit in with the surroundings; in summer or winter-sports regions, a different style of architecture or treatment may be in order; and at a seaside or lake region, some other treatment will be called for.

The particular community to be served oftentimes has some bearing on the scheme of modernization. The requirements at suburban stations are entirely at variance with those at urban stations. Each project is a problem in itself, and no general rule can be applied.

When building new lines of railway, it was customary to construct station buildings at intervals of 10 to 15 miles. Invariably, these buildings were constructed of wood throughout, as this was the most convenient material available and afforded the simplest construction. Many of them have served a long and useful life, and are still in use. These stations were often constructed to provide both passenger and freight facilities, and sometimes provided living quarters for the station agent. It is almost impossible to modernize such stations.

As time passed, better structures replaced these frame buildings in the more important localities, either because of the destruction of such buildings by fire, or at the insistence of the communities served. Now and then improvements were added, such as steam or hot water heating systems, sanitary facilities and electric lighting—usually by request of the local authorities in connection with the construction of municipal water and sewer systems and the extension of electric service to the locality.

Many stations constructed prior to 1930 had two large waiting rooms, with an enclosed ticket office located between them; also baggage and express rooms located at either end of the building. Present-day practice is to provide only one large waiting room, and possibly small retiring rooms in connection with the toilet facilities. This construction has proved very satisfactory for present-day needs, and should be kept in mind when making studies for the modernization of old stations.

Provide Space for Other Uses

Oftentimes, a plan can be worked out to eliminate one waiting room, thus providing space for other uses, such as a roadmaster's office, a yard office, or additional space for an office for an express agency. It appears that in the last few years the express agencies have come to the conclusion that an office in a railroad station serves their purpose just as well as an up-town office. This should be encouraged as it brings rental income to the railways, as well as more business.

In certain southern states, conditions are somewhat different with respect to providing only one large waiting room, in that it is necessary to provide separate waiting rooms and accompanying sanitary facilities for white and colored patrons.

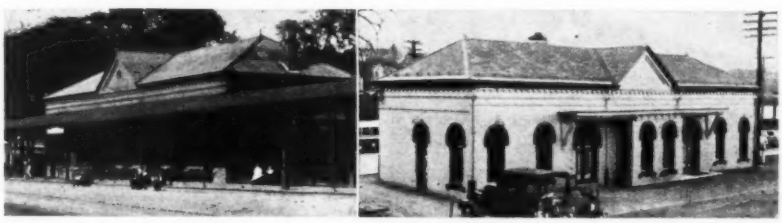
In making alterations to a frame structure, consideration should be given first to the foundation. If it rests on pile stubs or mud sills, they should be replaced with concrete. In some cases it may be desirable to retain the wood floor system. If so, grilles must be placed in the foundation walls to provide proper ventilation. Metal termite shields should be installed in those localities where termites are a problem. A better and more permanent job, as well as a more sanitary one, would be to remove the entire wood floor system, fill with sand, gravel or cinders, and construct a concrete floor over the entire area. Such a floor should have metal reinforcement to aid in preventing cracks. This may be of No. 6-gage, 6-in. by 6-in. electric-welded wire mesh. which should be 2 in. below the surface.

Side Walls

Improvements to side walls of frame stations can be accomplished in various ways. There is nothing wrong with good frame walls as originally constructed, with the possible exception of the trim that was used in former years. This trim can be replaced with more modern types at little expense. The siding material is usually in fair condition, but covered with layer upon layer of paint. These layers of paint must be removed before it will be possible to do a good paint job. In cases where it will be expensive to remove the paint, and the siding is in need of extensive repairs, it may be more economical to replace it all—possibly using a more desirable material.

Asbestos-cement material, either siding or shingles, can be applied to frame walls with success—assuming that proper precautions are taken, such as providing a concrete foundation beneath the structure, and brickwork facing to the height of the window sills. Before applying the new siding, a waterproof paper should be applied to the old wood siding, the siding being nailed or screwed in place. Battens of the same material must be applied over all joints if asbestos-cement sheets are used. All trimming is usually of wood.

Some years ago, stuccoing was the fad, and railroads did considerable of this kind of work. The usual practice was to nail a wire mesh to the wood siding and then apply the stucco. Some of these jobs were good, but many were bad. Cracks appeared, due probably to settlement of the foundations or to vibration from passing trains. Stucco can be damaged severely by the movements of baggage and express trucks on the platform side of a station, and by vehicular traffic on the street side. Proper concrete foundations are necessary for stucco jobs, and it would be best to provide brickwork from the platform level to the height of the window sills, with the stucco extending from that level to the eaves. Stucco applied to cement, haydite or cinder concrete blocks has lasting qualities. However, except for certain southern states, where climatic conditions are favorable, its use for railroad structures is not recommended. Probably the best of the improvements that can be made to frame side walls is brick veneer. However, this is rather expensive, and the usual type of frame structures will not warrant the necessary expenditure.



The Passenger Station of the New York Central at Hudson, N.Y., Before and After Recent Modernization

The side walls of many of the older brick stations were generally constructed of stone to the height of the window sills, with pressed brick above to the eaves. Such walls become quite dark and grimy over a period of years, and get very little attention, if any, in the way of cleaning. Any project for improving the appearance of such stations should take into consideration tuck pointing and cleaning. The cleaning of stone and brick walls can be accomplished readily by steaming, and at a reasonable cost. Sandblasting of stonework might be resorted to, but it tends to injure the texture of the stone facing. On brick work, a satisfactory job can also be obtained by washing it with the proper solution of muriatic acid, or other chemical, and then rinsing with clear water.

Doors and Windows

The windows and exterior doors of any station under consideration for improvements should be removed and replaced with those of modern design. Many of the doors in the older stations are more than seven feet high, with panels and trim of an antique design, and hardware of the same period. The windows are of similar construction, and, in most cases, are well worn and loose. It is essential that all such millwork be replaced. All windows should be weather-stripped; double-hung windows are preferable to the casement types. Windows, with the upper sash divided and the lower sash providing for a single pane of glass, have a neat appearance. In some cases, horizontal muntins may be used to carry out certain architectural features, or even glass blocks may be used effectively in many cases.

Roofs, Dormers, Gables, Eaves

In the older types of structures, one finds many peculiar innovations that are intended to draw attention to the roof structure. These include massive towers, or steeples, supporting clocks or weather-vanes; small iron fences along the ridge lines; dormers of various shapes; gables, with an abundance of carved wood designs and latticework, also, wide overhanging eaves. Probably no consideration was given to future maintenance of these appendages, and, in most cases, no maintenance was given. In general, much of this ornamentation should be removed, thus improving the appearance of the structures.

Floors

Most of the older passenger stations were provided with wood floors throughout, which, in time, become badly worn. Probably the most satisfactory improvement that can be made to such floors is to cover them with asphalt or rubber tiles. Such tiles are manufactured in various sizes and in a multitude of colors. The size of tiles should be determined by the size of the room involved, using small tiles, say 6-in. by 6-in., in a small room, and larger tiles, say 9-in. by 9-in. or 12-in. by 12-in., in a large room. A border strip can be arranged for, and, if desired, various figured designs can be laid inside of the border.

The proper color will vary with the location and with individual taste; however, the color should not be too light. A pleasing effect can be obtained with red and black tiles, laid alternately; or, mottled colored tiles of various shades of brown and green. A molded rubber base, about 4 in. high, with cove at the floor line, should be provided along all walls, and particularly in the toilet rooms.

In laying such tile floors, certain advance preparations must be made to

secure a satisfactory job. If the floor is badly worn, it may be necessary to fill low spots with a mastic, after which, a thin sheet of asbestos-cement or plywood should be nailed to the floor to provide a perfectly smooth surface. A layer of felt paper is glued to the surface thus prepared, and on this the tiles are laid in a specially prepared mastic, and then rolled. For this type of floor covering, it is essential that the floor structure be of sufficient strength, and firm, to prevent springing or weaving under traffic.

Existing wood floors, when badly worn, can also be improved by laying another wood floor over them. The new flooring may be hard maple, edge-grained fir, or pine, and can be laid at reasonable expense.

In some instances, it may be best to remove the old wood floor system entirely, backfilling with sand, gravel or cinders and constructing a new concrete floor. Such floors are hard, and appear cold in natural cement finish, but they can be colored with mineral pigments and laid in tile designs to enhance their appearance.

It is highly desirable to install tile or mastic floors in toilet rooms, as wood floors are hard to keep clean and soon become a nuisance. Such floors can be laid over wood construction by sheathing between the joists, filling in with concrete with light mesh reinforcing, and laying the surfacing material on this construction. This construction may result in a small change in elevation as compared with the adjacent floor, but this can be taken up with a sloping threshold.

Walls and Ceilings

The walls and ceilings in some of the older stations are covered with dressed, matched and beaded lumber; the casings about doors and windows are of an ornamental design; they have wood baseboards, wainscots, caps and picture molds; and the ceilings are generally from 12 to 16 ft. high. An examination of such walls and ceilings will show shrinkage cracks, loose boards and warping. To paint such surfaces does not help their appearance much.

Within recent years, a number of new types of wall and ceiling coverings have come into the market, and, as a result, a designing architect now has an opportunity to use his talents along decorative lines. Some of the more popular types of new wall coverings are pressed woods, cane fibre boards, and boards composed of cement and asbestos fibres. The last named material can be obtained in a number of different colors, such as light green, buff, rose, grey and black. The other materials can also be obtained in various shades and designs.

For ceiling material, scored wood, or cane fibre insulating board can be obtained readily. This material comes with ship-lap or tongue and groove joints, and one-half, three-quarters and one inch thick—the half-inch material being used generally for ceiling application. Various sizes of panels, or scoring, can be obtained and laid up in interesting patterns. The material should be backed with a ply of heavy waterproof paper to prevent "breathing," or the passage of moisture-laden air, which quickly stains the finish. It can be painted, if desired.

When applying the asbestos boards, hard pressed-woods or cane fibre boards to walls, all wood trim about doors and windows, wainscot cap, baseboards and other trim, must be removed to provide a smooth working surface. It is best then to apply a layer of felt paper, tacking it to the wall. The covering material is applied and held in place with aluminum or other types of moldings. These moldings are of various shapes for vertical and horizontal joints, inside and outside corners, and caps. All wood trim in redecorated areas should be of the modern narrow types.

Unusually high ceilings are not an uncommon feature in older stations and it is often desirable to fur them down to obtain better room proportions. In some cases, the area thus afforded above the new ceiling can be used effectively for housing the ducts from modern unit heaters and evaporative-type coolers.

There are several so-called interior stuccos on the market that can be applied in interesting textures, and, being self-colored, require no painting. Furthermore, this material can be cleaned and will require no painting for a considerable period of time. Interior colors of medium light to light shades are preferable to the darker shades, because of their aid to improved lighting and the added atmosphere of cheerfulness which they give to the surroundings.

Ticket Office

In stations where two waiting rooms are in use and the ticket office is mid-way between them, there is very little that can be done to improve the general appearance unless the office enclosure is entirely removed. A railroad in the middle west removed such an enclosure in one of its stations and replaced it with an open ticket counter. Where it is possible to dispense with one of the waiting rooms, or to make one general waiting room, the ticket office can be constructed across one end of the area, providing a pleasing appearance.

In any ticket office, it would seem that the ticket windows could be made more attractive by removing the grille work and substituting a glass panel, with an opening at the counter level and another opening for a "speak-hole." A variation of this would be horizontal strips of glass, about two inches wide, set about an inch apart.

As for the interior of the office, the old-fashioned ticket cases should be replaced with modern back counters fitted with drawers for tickets and cash. File cases, pigeon holes and various drawers should be provided beneath the ticket window counter, so that nothing in the office shows above the counter level.

Furniture plays an important part in modernization schemes. Well-designed wood settees have a neat appearance and can be made comfortable. Such furniture is substantial and cannot be damaged easily. However, the trend is toward chairs and lounges with chromium-plated tubular steel frames and bright-colored leather or fabric upholstery. Such furniture is subject to malicious damage and should not be installed except where policing is constant.

Telephone booths, luggage lockers and various vending machines can be made to fit in with modernization work; some of these facilities can be built into partition walls.

Electric Lighting

Electric lighting was installed in many of the older stations some time after the original construction. In many cases, conduits and outlet boxes were left exposed, and drop cords were provided with ordinary reflectors over the lights. In such cases, practically all conduits, wiring and lighting fixtures should be removed and replaced. Lighting fixtures are an important part of modernization, and regardless of how much a room is refurnished, old style or ordinary commercial lighting units will nullify the appearance. Modern fixtures, or specially designed units suitable to the room treatment, should be used. Very effective decorative schemes can be designed with the use of fluorescent lights; such lights have become quite popular. Ample illumination should be provided, erring to over, rather than under lighting.

Decoration

Decoration is a vital factor in the appearance of a building, both interior and exterior, and appearance is very important in station buildings, where the public interest is paramount. The present trend is toward colors—even

bright colors. Most of the materials now available for inside walls, ceilings and floor coverings are colored, and a variety of selections can be made. Present practice is for a comparatively dark wainscot, lighter wall coloring to the ceiling level, and still lighter ceilings. It is best to select a floor covering of the darker shades, or of mottled browns and greens.

As for outside decoration, or painting, most railroads have standard colors for frame buildings. However, if any appreciable degree of success is to be obtained in modernization work, there must be a deviation from such standards. It is believed that the reaction of patrons to a break in the monotony of standard colors will be quite favorable. The standard paint colors of individual roads should not influence the color scheme. In fact, some roads with streamlined passenger equipment are decorating their stations to harmonize with the color schemes of their modern trains.

Heating Facilities

Most stations, where modernization might be contemplated, are already equipped with an adequate heating plant. If the piping of such a plant is exposed, consideration should be given to placing it out of sight—preferably on the basement ceiling if there is a basement or space for such pipes under the floor; otherwise, by providing a trench in the floor. Pipes that lay along the baseboard are unsightly and provide space for the accumulation of dirt; overhead pipes do not have this disadvantage, but are not much better in appearance.

Radiators are nearly always placed at the windows, and, for that reason, must be low and long. They are placed in this location because the infiltration of air is greatest at the windows. Where space occupied by radiators is an important factor, recessed types may be used. Metal covers on radiators improve appearances.

The use of unit heaters in passenger stations might be considered. Many waiting rooms are very high, and unit heaters drive the heated air from the ceiling areas towards the floor level. Furthermore, circulation of the air will be much improved.

Toilet Facilities

Probably there is nothing at a passenger station that is talked about more than the toilet facilities. Health authorities are continually advocating better and more modern facilities, and their proper maintenance. Other forms of transportation have given special attention to such facilities, which has brought favorable comment repeatedly from the traveling public.

The entrances to the toilet rooms for men and women should be at least 20 ft. apart; they should be neatly labeled, and so located as to be not too conspicuous. The floors of the rooms should be of an impervious material, such as cement, or various types of tiles, with a cove base of similar materials. All walls and ceilings must be of plaster or some other non-absorbent material. It is preferable to omit any woodwork, and, with that in mind, all toilet stalls should be of metal construction.

It has been the custom for many years to install toilets with high tanks, pull-chain flushing device, and full rimmed seats with hinged covers. The present-day practice is for low tanks and open-front seats with no covers. Flush valves, in place of tanks, are preferable, but the proper size supply pipe must be used.

Urinals should be of the floor type, with an automatic flushing device, and should be placed on 24-in. centers. This type obviates the necessity of floor drains, which should otherwise be placed in toilet rooms for use when washing the floors. Pedestal-type urinals are used on some railroads and have proved quite satisfactory.

A lavatory should be placed in each room, fitted with chromium-plated fixtures. As hot water is seldom available at outlying stations, it is customary to install a cold water faucet only. A neat mirror may be installed in each room at slight expense, which adds to the appearance of the room and the comfort of patrons.

Some roads have installed colored fixtures. These can be obtained in various colors such as maroon, green, yellow and black. When installing colored fixtures, care should be taken to redecorate the walls, ceilings and floors to harmonize with them.

Drinking fountains should never be placed in toilet rooms. Obviously, they should be placed in close proximity to such rooms in order to take advantage of shorter waste, vent and supply piping. The bubbler-type of fountain should be discouraged; in fact, many states prohibit its use. The angle stream type is recommended.

Platforms

The original platforms built at small stations were nearly always of wood, or, for more important stations, of brick. Wood platforms are a source of continual maintenance and should be considered for replacement with permanent types when improvements are contemplated. Brick platforms were very popular until the advent of concrete, or cement platforms. They have the advantage of easy maintenance and present a good appearance. Concrete platforms are good, but must be placed on firm foundation material to avoid settlement and consequent cracking and disintegration.

At the larger stations, platform shelters are essential and cannot be dispensed with entirely. However, there are many locations where such facilities are no longer needed and can be removed, thus saving maintenance expense and adding to the appearance of the station building. In other cases, a large portion of the shelter can be removed without disadvantage.

The wide overhanging eaves on most of the older stations present a problem for any one attempting to improve the outside appearance of such a building. In some improvement jobs, such eaves have been removed entirely; in others, only partly. These wide eaves not only present a poor appearance, but exclude daylight from the interior, resulting in dark, dismal rooms. Any alterations to the roof structure should include consideration of the alteration of overhanging eaves.

Today, parking space for automobiles is very essential, not only at suburban stations, but also at outlying stations as well. Such parking areas and driveway approaches to the station should be improved with cinders or chats, where available.

Conclusions

It is obvious that the modernization of each station presents a separate and distinct problem, and that it should be considered as such. Much of the work to be done rests with the individual in charge of preparing the plans, subject, of course, to the approval of his superior officers.

This report should be considered as a series of suggestions, or possibly as a guide, as to what might be done to modernize an old passenger station. It is evident that improvements should be made to some of the more important passenger stations to keep abreast of the times.

Committee—L. C. Winkelhaus (chairman), arch. engr., C. & N. W., Chicago; W. A. Hutcheson (vice-chairman), supv. b. & b., C. & O., Clifton Forge, Va.; L. E. Peyser (vice-chairman), asst. arch., S. P., San Francisco, Cal.; C. F. Berg, engr. draftsman, C. & N. W., Chicago; P. B. Collier, asst. supv. b. & b., M. P., Monroe, La.; H. M. Harlow, asst. supv. b. & b., C. & O., Clifton Forge, Va.; W. A. Huckstep, arch. div., M.P. St. Louis, Mo.; D. H. Johnson, supv. b. & b., C.St.P.M. & O., St. Paul, Minn.; W. W. Kerr, asst. engr., C. & N. W., Chicago; T. S. McMahon, arch., G. N., St. Paul, Minn.; J. A. Moore, supv. b. & b., C. & E.I., Danville, Ill.; A. W. Nelson, asst. engr., C.M.St.P. & P., Chicago; F. A. Scites, supv. b. & b., C. & O., Huntington, W. Va.; J. W. Secker, bldg.

insp., C.M.St.P. & P., Chicago; and W. A. Sweet, gen. fore. b. & b., A.T. & S.F., Newton, Kansas.

Discussion

Emphasizing that need for the modernization of stations is pressing, A. Chinn (Alton) called attention to the inconsistency of requiring passengers to come through dingy, outmoded and sometimes dirty stations to board the new streamlined trains. Aside from this, however, he contended that the railways should consider the competitive feature of these outmoded stations, for bus and air lines have given much attention to the design and appointments of their stations, and the contrast between the old railway stations and the newer stations of the competing lines is a subject of much comment. He has on his road many stations with high ceilings; and in any modernization scheme these ceilings should be brought down to a lower level, thus making the rooms far more attractive and easier to heat. Mr. Chinn also called attention to the outmoded toilet facilities and appointments in rest rooms in practically all stations that have not been modernized within the last year or two.

L. P. Kimball (B. & O.) inquired about the new system of radiant heating and whether any one present had any knowledge of railway or other installations.

Efficient Methods of Transporting Bridge and Building and Water Supply Gangs

Report of Committee

S. S. Long
Chairman

THE fact that this subject was chosen by the association for study during the year, convinced your committee that there exists some, if not considerable, apprehension that the methods now employed by many railroads in transporting bridge, building and water service employees, are inefficient. Accordingly, it seems advisable to review briefly the circumstances from which the methods developed which are more generally employed today for transporting men to and from work, the objections that there may be to such methods, and finally, the improvements that are available and that offer opportunities for substantial economies.

Early Practice

Years ago, when railroad construction was a major undertaking, tracks were advanced through unsettled regions, across plains, through forests and over mountains—all mainly in wilderness where the housing and feeding of men were necessarily the first problems for which arrangements had to be made. It is readily understood why camp cars came into existence as a practical means of caring for a large number of men whose work was continually pressing forward, because the mobile camp, conveniently handled on the newly laid rails, solved that problem well.

As parts of new lines were placed in operation, these large camps became fewer or disappeared, to return only with infrequency when extensive rail renewals or ballast work demanded their use. But the maintenance of track, bridges, buildings and water supply facilities called for means of taking care of small groups of workmen, some of whom, by reason of their duties, had to be moved from one locality to another, often for emergency work and over long distances. Among these were the bridge and building gangs and the water service employees whose small camp units, generally known as outfit cars, naturally became not only common, but afforded the most practical and economical solution. The cars could be moved from one siding to a distant one, or could be spurred out to place the men within reasonable operating limits for their hand car, or, in more recent years, their track motor car.

During the long period in which the old reliable hand car not only took the men to and from their points of work, but often enabled employees, and others as well, to reach towns where they could enhance the gate receipts at dances and other places of interest, there were only dirt roads or trails, often few and far between, and no motor vehicles. The railroads were necessarily depended upon for local as well as long-distance transportation of persons and property. Locomotives and trains were relatively small; they operated frequently; sidings or spurs were numerous, so that outfit cars could be moved promptly from place to place and material could be distributed at bridges and other points between stations with little detriment to train operation. Neither was there serious loss of time to gangs in those days of longer working hours, when the delayed way-freight might arrive at the unloading point at an hour that would now be far beyond quitting time in the zone of overtime, an unknown headache in those days.

Conditions Have Changed

But look at the picture today. Train makeup and operation, both passenger and freight, have changed radically. Runs between stops are long and at high speed, and extra stops, or even slow-downs cannot be justified. Neither can present-day heavy freight trains be used to pick up, move and set out outfit cars without disrupting and penalizing the cost of train operation. Way freights, as we used to know them, have, to a large extent, disappeared, so, in addition to the problem of getting outfit cars moved and moved when the progress of the work requires, there is little opportunity to provide train service economically for the unloading of small amounts of material between stations. Changed passenger service has greatly reduced or eliminated the opportunity to send men to points where perhaps a small repair job must be taken care of quickly, or where a car must be released of its load. Men in outfit cars can no longer get to their homes over Sundays without entailing a con-

siderable loss in productive working time during regular hours.

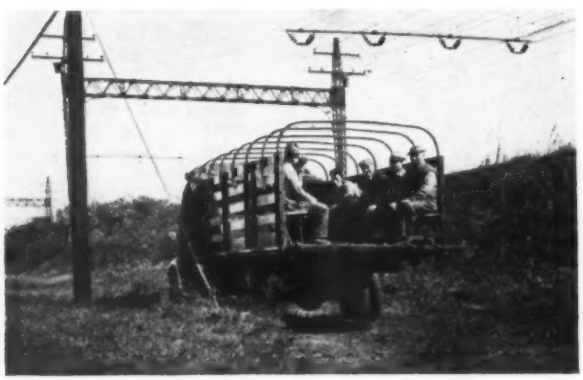
Because of the changed character of train service, the track motor car, which has been gradually improved so that, under proper care, it is reasonably dependable, has been pressed into the long-distance hauling of heavy material and of men. Both of these factors add to the hazards of motor car operation and increase maintenance costs materially. The difficulties of track car operation have been greatly increased, not only because of the faster and heavier trains now prevalent, but also because of the elimination of many communicating stations, which decreases the opportunity to keep in touch with train movements.

Coincident with these outstanding changes in operating conditions on the track, improved highways have been developed, which in numerous instances parallel our railroads and pass the bridges and other intermediate structures in reaching towns or stations along the way. Furthermore, these highways checkerboard the land, radiating as the spokes of a wheel from the larger centers, with the result that short-cuts have been established between many railroad stations, particularly on those lines that cross each other, or which tend to parallel each other, though perhaps at remote distances.

These highways have been built and improved for the declared, if not the actual, purpose of serving the public needs. The railroads have contributed largely to their cost in one way or another—yes, have often paid unfairly and dearly. Why then, should not the railroads avail themselves of all the opportunities there may be to use these highways advantageously in accomplishing their primary purpose—that of mass transportation of persons and property on the rails?

One field for such study lies, unquestionably, before this association—that of transporting workmen with minimum travel time, and of supplying them with material by a means that will insure its delivery when needed, with the minimum elapsed time between the store room and the point at which the material is to be put to use. First, let us explore the possibilities of transporting bridge and building gangs. Necessarily, at the larger terminals, such maintenance forces are centralized and are maintained in greater numbers than elsewhere. It is there that workmen have their homes and are available when conditions require increasing forces, perhaps quickly, to cope with some emergency. It is there that the stores department is represented and has the materials and tools we need.

In many instances, a railroad has more than one line through such terminals, but, in any event, there is much nearby work for bridge and building men at such points, with their terminal buildings, street subways, suburban stations, interlocking towers and industrial tracks with their bridges and coal trestles. Gradually as the distance increases from the center of large terminals, the bridge and building work becomes more scattered and decreases per mile of railroad. Relatively, similar conditions exist at the smaller terminals, the natural headquarters for maintenance forces. At these latter points there may be, in addition to company buildings and other facilities, various industrial tracks, including mine tracks, on which bridge work is necessary. At all of these terminals track car operation is difficult, if not impossible, because of frequent train and switching movements or cars blocking the tracks that must be used.



The Three-Ton Truck, With "Stake Body" and Removable Canvas Top, Satisfies the Requirements of Many Bridge and Building Gangs

Less Delay With Trucks

In some localities, some railroads have already adopted the use of highway vehicles for transporting bridge and building gangs, and, apparently, with gratifying results. In addition to the ability to operate at greater speeds on the streets and highways than on the rails, there are not the delays incident to clearing for trains and yard movements, or due often to finding tracks blocked with standing trains or cars. According to the distance from headquarters that can be traveled to advantage by highway conveyances, it has been possible to reduce or eliminate the use of outfit cars for the use of gangs being dispatched to their points of work.

Increased Flexibility

There is unlimited flexibility in the use of highway vehicles, permitting the sending of just the right number and kind of men to handle a job, whereas a crew in outfit cars is normally fixed in number as well as with classification of individuals. This latter situation results all too frequently in there being fewer men on certain specific jobs than are needed to handle the work properly, including flagging, while in other cases there are too many men for the jobs at hand, such as adjusting stock yard gates or fixing a coal bin. Furthermore, the cost of the work is often penalized by the necessity of using mechanics to do laborers' work—for example, a carpenter crew excavating, or placing or readjusting rip-rap.

Hand in hand with the transporting of men is placing within their convenient reach the materials and tools they must use, and having them there at the right time—not too late, neither too far in advance, lest there be loss by theft or the station warehouse be cluttered with aging company property. The material should remain with the storekeeper as long as possible, not only for its protection, but to minimize the stock investment. Special tools and equipment should be kept at central headquarters for dispatching only as needed, thus permitting greater utility by being able to care for the needs of more crews. The highway truck has demonstrated its practical usefulness to such ends.

Type of Highway Vehicle

As in the case of much roadway machinery developed for use on or off track, the highway conveyance immediately presents obvious advantages. However, as with roadway machines, the true test as to its economy rests with the ability to keep it gainfully employed. This demands definite and daily supervision on the part of someone, after a study of local conditions and requirements has determined the kind of vehicle or vehicles that will best meet the needs of the district, and what departments and crews will be serviced by them.

In consideration of the foregoing,

it appears that a highway vehicle is needed which can be used for transporting men and some materials simultaneously, and be adaptable readily to the handling of bulky and heavy materials alone—yes, even small buildings, such as flagmen's cabins. These requirements are satisfied to a quite satisfactory extent in the "stake body" truck of three tons capacity, sheathed on both sides of the stakes and covered with removable bows and canvas. The body, 7 ft. wide and 16 ft. 6 in. long, is provided with plank seats, designed for convenient folding or entire removal when the space is needed for handling material. There are other special features possible in this type of truck, such as tool boxes, a compartment under the body for handling safety cans of gasoline, a tail gate and suitable rear view windows. This description of one type of conveyance is brief, if not vague, and is offered only to suggest the possibilities of design which will result in maximum efficiency, considering the investment.

At the present time, many railroad officers are concerned with the question, "Can I increase the efficiency of certain maintenance of way men and, after all costs are figured, show a real and substantial reduction in expenses by utilizing the highways? If so, what is the procedure?" The answer to the first question can, no doubt, be determined best by obtaining figures from those who have undertaken such operation. The answer to the second question, in part at least, might be based on an actual trial, utilizing the suggestion offered herein with regard to the type of truck.

At the larger terminals, suitable trucks will definitely expedite the movement of bridge and building gangs to and from work, and will readily permit the distribution of the different members of the gangs so that all may be employed advantageously on necessary work. Furthermore, they will insure keeping these men supplied with the material they need direct from the store room or headquarters, thus eliminating the possibility of its theft, going astray, or being stored in some building where, perhaps, it may be forgotten. In addition, they will make possible the immediate and proper disposition of material removed or left over upon the completion of the job. One truck can readily handle and supply several crews within a limited radius, and also have time in which, under proper supervision, to serve the needs of other departments. One of these departments is the track department, the gangs of which, with motor and push cars handling small track material, welders' gas cylinders, etc., often have difficulty in getting through a congested area to a job, and then returning the released scrap and usable material to a proper place before some one, who can afford a truck, steals and carries it away, or some boy, who does not realize the probable consequence, places a spike or other small piece of metal on the rail.

On-Line Jobs

Beyond the terminals, larger cities and yards, the situation with regard to the use of highway trucks is different, possibly to the extent that general use of the highway by bridge and building gangs is questionable from the standpoint of economy. However, it is thought that, in all probability, the instances in which highway usage will not pay will prove to be exceptions, and relatively few. Good highways provide ready access to practically all miscellaneous buildings, including water and fuel stations. Many bridges can also be reached by them, although not all.

If there is no road near a bridge, access to it may be obtained, with permission, through a field. Failing in this, in some instances, the truck may serve advantageously to reach the point of highway-railroad contact nearest the bridge, from which point a track car, or cars, as necessary, may be used to reach the bridge. Generally, such limitations will be few and encountered infrequently on any district that would be selected for serving by means of highway vehicles.

Under proper planning, bridge work at locations inaccessible by good highways can be completed during the warmer weather, and any ordinary winter work confined to bridges that are easily reached—preferably those nearest headquarters. Winter conditions in the colder states, especially those subjected to much snow, create many emergencies for bridge and building and water service forces. Building emergencies are confined largely to terminal facilities, such as enginehouses, turntables, coaling stations and similar important operating facilities, while emergency bridge work is relatively small. Streets and highways are usually kept open during snow storms or are made available soon thereafter, so that forces can be dispatched by truck or automobile with little or no delay. On the other hand, it may be impossible to operate track cars at all under such conditions or such operations may be slow, unusually hazardous and, not to be overlooked, they may be a cause of extreme discomfort and fatigue to the men.

In a specific length of time, crews can move a far greater distance in trucks or automobiles than on track cars. Delays are minimized on the highway, while they are uncertain and difficult to foresee in rail traffic; hence, in trucks or autos, crews can be transported to and from working points located far beyond the limitations governing track car operation. Outfit cars, perhaps, cannot be eliminated entirely, but surely there is opportunity to reduce their use greatly. An arrangement whereby bridge and building men can reach their homes at the close of the day is of mutual advantage to them and to the railroad.

Track Motor Cars Are Operated With Difficulty in Many Territories, But Still Have a Place Where They Can Be Used to Advantage

Trucks for Water Service Work

Water service forces can take advantage of the highways even more readily than can bridge and building gangs, because invariably their points of work are reached by highways—more often than not, improved ones. Furthermore, in the majority of cases, only a small crew is involved, frequently only one man; the work is laregly "trouble shooting," and a light truck is ideal for their use, either in quickly taking care of an emergency situation or in their daily routine. Some railroads have provided all or part of their water service forces with suitable highway conveyances and report highly satisfactory results. In many instances, individu-

als use their own automobiles with or without an allowance, but in the latter case, it appears that the benefit accrues mainly to the employee through his ability to reach his home more frequently or readily than would be possible otherwise, rather than in an extension of territory to effect a saving for the railroad.

Several major items must be considered when comparing rail and highway transportation of maintenance forces. Among these are the investment in and upkeep of the equipment, and the element of safety. With respect to the latter, the highway vehicle seems to offer some advantage. Highway vehicles must be inspected frequently, with regularity and thoroughness, and must be kept properly serviced and in good repair to insure safe operation, as well as to prevent costly delays. This demands that the driver be selected with proper consideration to these matters, and that he be trained to utilize a part of the time that his truck is necessarily idle to make minor repairs and adjustments. Insurance and license costs must not be overlooked.

The deliberations of your committee have revealed many ways in which it is felt that highway vehicles can be utilized to increase efficiency in railroad maintenance work and permit the showing of decided reductions in maintenance costs. We believe that the gradual expansion of the use of such vehicles under intensive study and proper supervision will unfold new and practical advantages, almost unlimited.

The power unit in a truck is, in itself, a potential maintenance tool if harnessed suitably; it can be adapted to the operation of power tools and can be used for hoisting and skidding. A dump truck has its place in some localities, although, because of poor riding qualities and its general construction, it is not entirely suitable for transporting men, except over short distances. Here, rental may well pay when investment would not. The use of trailer camps in conjunction with highway conveyances, especially in more remote locations, offers some possibilities. A light truck or automobile in the hands of a general foreman permits him to expedite his inspections and contact with scattered jobs under his jurisdiction.

Conclusions

In conclusion, the results of the study of this subject by the committee may be summarized as follows:

(1) The track motor car provides the natural means for transporting men and lighter materials by rail over relatively short distances. It requires, however, that outfit cars be used extensively.

(2) Until more recent years, outfit cars and track cars were the only means available for housing and feeding men, and for moving them to and from their work. We now have improved highways, which present an opportunity to transport men, tools and the lighter materials by truck, greater distances, and in less time than is possible with track cars.

(3) Changes in train operation have placed upon the maintenance forces the burden of determining the most efficient and economical means of transporting men and material to and from points of work.

(4) The use of the highways permits the concentration of forces at the larger terminals and headquarters, thereby enabling the supervisor to assign men to various jobs more advantageously from day to day, and to use to better advantage the tools and equipment at his disposal. Suitable highway conveyances make it possible to expedite the special rush jobs, large or small, and to take care of emergencies at distant points, near which no crew may be located.

(5) The handling of material by truck makes it possible to maintain smaller stocks, prevents loss and theft, and insures delivery at the time needed.

(6) The elimination of or reduction in the number of outfit car units relieves the operating department of costly interference with train operation. Handling material by truck may frequently obviate expensive work-train service.

(7) Light trucks or automobiles permit greater efficiency on the part of water service employees and others, including general foremen and supervisors.

(8) Close supervision of highway vehicles will result in valuable assistance in many ways, not only to those in the maintenance of way department, but to others as well.

Committee—S. S. Long (chairman), div. engr., C. & N. W., Green Bay, Wis.; A. D. Gillis (vice-chairman), supv. b. & b., N. Y. N. H. & H., Providence, R. I.; H. T. Bishop, asst. supv. b. & b., C. & O., Richmond, Va.; J. H. Brandt, supv. b. & b., C. & O., Columbus, Ohio; L. G. Byrd, supv. b. & b., M. P., Poplar Bluff, Mo.; A. Chinn, ch. engr., Alton, Chicago; R. A. M. Deal, supv. b. & b., Sou., Richmond, Va.; A. M. Glander, ch. carp., C. M. St. P. & P., Mason City, Iowa; R. E. James, supv. b. & b., L. V., Roselle Park, N. J.; A. C. Jones, supv. b. & b., Sou., Parrish, Ala.; C. R. Knowles, supt. w. s., I. C., Chicago; H. M. Mason, gen. fore., A. T & S. F., Pueblo, Colo.; J. R. Penhallegon, supv. b. & b., C. & N. W., Chicago; J. M. Salmon, Jr., asst. div. engr., L. & N., Middlesboro, Ky.; G. L. Sitton, ch. engr. m. w. & s., Sou., Charlotte, N. C.; E. E. Tanner, gen. supv. b. & b., N. Y. C., Albany, N. Y.; and M. G. Tribe, master carp., Erie, Salamanca, N. Y.

Discussion

Favorable comments by numerous members of the association in the discussion that followed the presentation of this report indicated that the use of trucks in maintenance of way work is regarded as an efficient and economical solution to the problem of transporting men and materials in many instances. J. P. Hanley (I.C.) opened the discussion by stating that trucks were particularly useful and effective in congested districts and were also valuable for reaching isolated locations on lines that had very little train service. He explained that the Illinois Central had about eight ½-ton trucks in water service work and reported that they were very effective for handling light materials.

Armstrong Chinn (Alton) expressed the thought that during the period we are entering it will be important to conserve both materials and manpower, and one way to do the latter is to keep the men on the job as many hours as possible during each working day, by transporting them to and from their work in the most efficient manner. A more widespread use of trucks may be the solution to this problem, he added, and gave an example of water service work on one branch line, in which two days were required for any job, no matter how small, if train service were used.

K. L. Miner (N.Y.C.) cited an agreement with a truck rental company which had offices in nearly all the principal towns on his division for renting drive-yourself-trucks of all types at 50 cents an hour plus 6 cents per mile. He thought that this system might be cheaper than owning trucks, particularly if they are not used continuously.

G. S. Crites (B. & O.) suggested that truck rental agreements for maintenance work might be arranged with those companies that already had agreements with the railroads for pick-up and door-to-door delivery service. Mr. Crites also suggested that in large terminals, where a large number of trucks are used, they should be pooled for the use of all departments, and a dispatching system organized in order to utilize them as fully as possible.

B. F. Francis (N.Y.C.) said that on his division the frequency of train movements made it necessary to operate motor cars by train order and that truck transportation was very necessary since motor car transportation was impractical in most cases. He also said that the bridge and building

supervisor and the supervisor of track share the use of three 1½-ton trucks and planned their work together to use them most effectively. He added that these trucks are maintained by the division shop forces of the maintenance of way department.

W. A. Huckstep (Mo. Pac.) mentioned the fact that the maintenance of way department on his road had a number of trucks in the larger terminals and that their operators were covered by a blanket insurance policy. In order for railroad men using private cars to come under this agreement and to protect the railroad, a rule was enforced that private cars must not be used without authorization.

Possibilities of Off-Track Equipment in Bridge Construction and Maintenance

Report of Committee

H. T. Livingston
Chairman

THE subject of this report, with all that it implies, is of great interest to all railroad officers responsible for construction, operation and maintenance. Historical records and descriptions of methods and equipment are of little value except as a basis for study of ways to improve them. Current practices sometimes become obsolete almost before the completion of a project. Descriptions of methods contained in this report, are suggestive only, and serve principally to challenge us to study and to originate. The acceptance of known and successful procedures without investigation of other and possibly entirely different methods, indicates decadence or mental laziness.

The use of off-track equipment is not of recent origin. Machines used in the early days of railroad construction and maintenance were not operated and moved on tracks. They were generally hand or horse-powered. The mounting of equipment on wheels for operation on the track developed naturally, and its use continued until the internal combustion engine became commercially practical and economical.

A few of the basic factors which have made off-track equipment possible are internal-combustion-powered units with light weight per horse power; cheap, concentrated fuel; compact electric-generating units; portable, automatic-operating air compressors; high-capacity cranes that permit greater latitude in design; power-driven tools; electric and acetylene welding; the crawler tractor; the development of automobiles and trucks; and the accessibility to railway structures from all-season highways.

Character of Work

The maintenance of a railroad property includes the replacement of all of its physical units, from the smallest to largest. The viewpoint of each officer is influenced by the character of the work for which he is responsible. The need to save time and money and to facilitate train operation is a universal objective, and should not be overlooked, regardless of the magnitude of any project. Bridge repairs may be regarded as minor and major, the minor work including that wherein the handling and unloading of special tools and equipment or the use of work trains are not warranted. This discussion presupposes that the work is sufficiently large to warrant the use of some type of work equipment.

Bridge maintenance on most railroads is divided into two general classes: (1) minor repairs to existing structures, chargeable wholly to operating expenses, and done by regular railroad bridge and building forces, and (2) major repairs, renewals and replacements, which appear on the annual bridge budget and are properly construction, rather than maintenance, items. Repairs in the first classification include the replacement of minor portions of frame and pile structures; deck renewals; the replacement of corroded or failed steel members; the adjustment of counters and expansion rollers; the replacement of shoes and bed plates; the renewal of masonry bridge seats and backwalls; the facing and encasing of piers; the protection of masonry footings from scour; repairs to masonry culverts and various types of waterproofing; the lining and grouting of arches; the installation of culvert pipe, etc. Major repairs include such work as the replacement of frame or pile trestles with treated timber or still more permanent structures of steel and concrete; the installation of permanent culverts; the strengthening of bridges to permit the operation of heavier locomotives; major changes in grade and alinement, involving bridges, etc. Work of this latter type may be contracted in whole or in part, or may be carried out by the organization of special company forces.

Why Off-Track Equipment?

The use of equipment, whether "on" or "off" track, which will save labor in carrying out either of the above classes of work, should be given careful study. Why is off-track equipment needed? This is answered best by analyzing the objectionable and "fixed" features inherent in the use of on-track equipment. Such an analysis considers (1), economy, and (2) safety of use.

Most on-track equipment is steam driven, using coal or fuel oil. Such fuel is generally available at subdivision points, which requires that either the equipment be moved to the point of supply, or that the fuel be brought to the site of the work and the equipment be refueled by expensive hand methods. Water is usually secured by moving the equipment to the nearest water station. Expenses are reduced, but not entirely eliminated, by providing additional water cars. Local water supplies are often secured by means of syphons, pumps, etc., although the use of such local water, untreated, frequently is uneconomical because of its detrimental effect on the boilers and the subsequent extensive boiler

repairs that usually are required.

The steam-driven on-track machine requires the employment of a night watchman, or the payment of overtime to firemen for building fires preparatory to work periods, and for the banking of the fires after the close of each day's work. Whether such work equipment is self-propelled or requires a locomotive, makes little difference, in principle, in this discussion. The self-propelled machine is generally more economical when the work site is close to a siding, but does not prove so economical when long distances must be traversed to and from work, and to clear for trains.

Driving Piles With a Crawler-Mounted Converted Dragline

On-Track Machines Are "Fixed"

The on-track machine is "fixed" as to work area at the job site. Its maximum radius limits the work which it—a pile driver, derrick, crane, etc.—is able to do. Such equipment, to be effective, frequently requires the construction of additional tracks, and may require temporary changes in local power lines to afford adequate horizontal or vertical clearances. The on-track machine is also "fixed" as to movement from one job to another. It must travel on the rails to any point desired, even though the distance across country to that point may be much shorter. Frequently, such a machine must, in moving from a job on one line to another job on a nearby parallel line, move 50 or more miles to a junction with the other line, and then return a similar distance to the new job, with a loss of one to as much as four days' time.

The on-track machine is also "fixed" as to the variety of work which it can do. Pile drivers are frequently used as derricks to load or unload material, but such use is uneconomical and should be limited to small quantities of material. The use of derricks is limited to areas near the track.

The economy to be derived through the use of any particular type of machine must be computed for each job, and a close estimate of costs, based on local conditions, can be made on the above mentioned points. Delays to the machine itself because of the necessity for clearing for trains can be estimated closely. The cost of delays to revenue and other trains, due to the actual stopping of trains at the work site or to slowing them down while the machine is clearing the main track, is indeterminate. It frequently happens that a machine will break down just prior to the time for clearing a main track, with consequent disruption of revenue traffic and resultant expenses at both prorata and overtime rates. Expenses for such failures cannot be foreseen, nor are they charged to the job, but they do increase the operating expense of a railroad. Any blockade of a main track, and especially of this unforeseen type, is unduly expensive, because train dispatchers depend upon expected performance of trains, and plan train movements accordingly.

Interferes With Routine Work

The use of any on-track equipment or work train is always detrimental to the efficient operation and maintenance of a railroad. It has been, however, largely a necessary evil. Such equipment or trains may have to pass through other maintenance or construction gangs, causing delay not only to themselves, but also to the gangs through which they must pass. Such movements are expensive, particularly to gangs laying rail, ballasting, or engaged in bridge erection. Local officers should plan their work to avoid such delays in so far as possible, but there are times when they cannot be prevented. An item of no small expense is the delay to other maintenance forces that must pass the work site during working hours. There may also be delays due to different hours of service for forces with different types of work equipment, causing overtime costs while waiting for the equipment to return to the nearest station at the close of the day's work.

In connection with most types of on-track equipment, there are certain fixed expenses which cannot be eliminated. Train and enginemen are generally required where the equipment is operated on main tracks and within yards. Contracts with the men in these crafts usually require continuous eight-hour daily pay, even though those in the maintenance-of-way crafts, in general, are paid for eight hours within nine, the lunch hour not being worked. If the lunch hour is actually worked, men in the maintenance crafts are usually paid full time for the lunch hour, with 20 min. off to eat. For the operating department men, therefore, there is at least one hour in a single-shift for which pay is given for time not worked, or for which pay is given at time and one-half. With on-track equipment, the time of both men in the maintenance crafts and train and enginemen, is usually based on starting and closing the day's work at the nearest station at which adequate lodgings may be had. Thus, unproductive time used in the trips to and from the work site must be paid for.

We are faced with unpredictable increases in expenses for the operation of on-track equipment due to unexpected interpretations of existing labor agreements, as well, as to the possible inclusion, in the future, of contract clauses which make necessary the employment of transportation employees who are not actually needed, and, in fact, who often slow up the work.

On-track equipment is generally built heavily and substantially. Repairs must be made at a shop, which generally produces long unproductive periods. It may become obsolete, but a railroad can seldom afford to scrap equipment for that reason alone. It has rapid depreciation for resale or trade-in, and the market for its resale is limited to short-line railroads. Furthermore, the cost of modernizing such equipment is generally prohibitive, as is also the cost of converting it for purposes other than those for which it was specifically designed originally.

On-Track Hazards

There are some hazards in connection with the use of on-track equipment that do not exist with off-track equipment. Occupancy of a main track constitutes a hazard to train operation, and, therefore, full protection must be furnished. The certainty and efficiency of such protec-

tion must be checked constantly. Those hazards that are peculiar to the operation of on-track equipment include collisions with other units; the fouling of clearances on adjacent tracks; impact with vehicles at grade crossings; collisions with motor cars or other maintenance units operated on the track; the swinging of derrick booms en route, etc.

Examples of interference with normal train operation by the use of on-track equipment are familar to all of us. On-track pile drivers, in addition to the period of driving, require time to clear the main track. The time of driving with such equipment includes the raising and lowering of the leads, whereas off-track equipment merely swings away from the track to clear it. Large air compressors installed on cars require the building of spur tracks at work sites, and either long air lines or the use of locomotives, with consequent interference with operation.

All on-track equipment, such as generators, air compressors, concrete mixers, etc., must be taken to the work site, with the accompanying interference and hazards from train movements. When major work is done on any main-track structure, some interference with normal work operations is to be expected. On-track equipment increases the extent of such interference by the aggregate amount of time required to clear the main track, plus the additional time required to complete the entire job, due to the smaller amount of work accomplished while the equipment is not able to operate. Furthermore, on-track equipment, particularly the large, heavy units with concentrated loads, does not lend itself readily to conversion to off-track equipment.

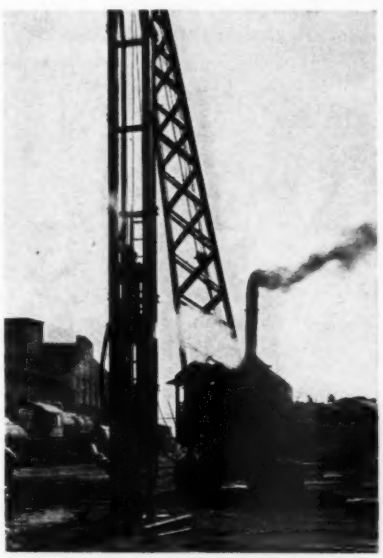
Crawler-Mounted Dragline

The use of the crawler-mounted dragline, which is readily converted for use as a crane or pile driver, has become universal where the character of the work permits. The conversion to a pile driver is effected by adding leaders and the use of a drop hammer which is operated from the same drum that ordinarily handles the excavating bucket. Where a steam hammer is required, an auxiliary boiler can be placed at the work site to furnish steam.

One of the accompanying views illustrates the driving of piles during the reconstruction of an overhead highway bridge. This same crawler-mounted converted dragline was used to remove the old bents and to install the new timber. Frame bents, instead of pile bents, were installed similarly in some instances. This type of equipment has also been used to drive piles to stabilize embankments. On another job, involving the reconstruction of pier footings adjacent to an operated track, a dragline converted to a pile driver, supplemented by a stationary boiler to supply steam for the hammer, was used successfully to drive steel, timber and sheet piles. By removing the leaders and hammer and equipping the unit with a clamshell, the same machine did all the excavation necessary, the excess material being hauled away on trucks. The same machine was also used as a crane to handle all heavy construction materials.

Another view herewith shows a steam ditcher, equipped with crawler treads, converted to a pile driver, operating a steam hammer that is driving foundation piling for a new turntable circle wall. The same machine can be further converted for excavating work.

The design and type of structure affect the method of construction and the procedure to be followed. The use of preframed timber in bridges



Steam Ditcher, Equipped With Crawler Treads, Converted to a Pile Driver

and trestles permits its rapid installation with a crane. The use of power-driven tools for installing hardware speeds up the work, as well as makes for uniformity in construction and reduces the time that slow orders must be in effect. Precast masonry units of relatively small weight can often be placed with off-track cranes. The use of culvert pipe that can be jacked through embankments may obviate the necessity for falsework needed for building a concrete box. The addition of steel, by welding, where feasible, to strengthen bridges, saves falsework. The use of power tools to remove old masonry in connection with the placing of grillages and the repair of concrete bridge seats should not be overlooked.

The driving of steel sheet piling around pier footings as a protection against scour, can often be done entirely by off-track equipment. The building of a sheet pile retention dam downstream from a bridge will generally stop further erosion of the stream bed at the bridge site. Masonry culverts of early design are often without floors or paving; these may be repaired by filling between the footings with local riprap, grouted securely in position.

The use of jets in driving piles, while not novel, is frequently overlooked. The application of crib walls may reduce the length of bridge needed. The above are but a few suggestions, but they serve to show the need of forethought in design.

Power-Driven Tools

Although the scope of this subject does not include power-driven tools, the use of such tools is so closely allied to the use of off-track equipment that attention must be called to them. Hand or gas-engine-operated cranes of one to five tons capacity may obviate the need of cranes of larger capacity, of either on-track or off-track types.

Gas-engine-powered cranes, similar to those used on highway wrecking trucks, can be used in deck renewals and bridge repairs and replacements. This type of crane is especially useful in removing drift from about structures during periods of high water. Its mobility permits a choice of location, such as on the bank of the stream, on the track, on a push car, or on a bridge pier. It can be moved over the highway to points of trouble that cannot be reached by on-track derricks because of intervening washouts. To repair simultaneously many breaks in the track, permits earlier resumption of normal train operation.

The two principal machines used by bridge forces that are operated on the tracks are the pile driver and locomotive crane. Obviously, these machines cannot be dispensed with entirely, because there are many jobs to which they are specially adapted. Thus, a certain minimum number of such machines must be maintained to meet emergencies. Railroad officers should, however, restrict their use to actual needs, and where justified. Such a policy will probably reduce the number of on-track machines retained in service and permit the purchase or rental of modern off-track equipment.

Even the motor car is subject to study for replacement with trucks. Men traveling to work by highway are not delayed enroute, and they arrive at the work site in proper condition to take up their work. To state that trucks can replace work trains entirely would be absurd. However, all types of work proceed on highways without work-train service.

Other Off-Track Equipment

In territory where suitable local materials meet specifications, it may prove profitable to install relatively small production units, such as portable crushers, sand and gravel production units, etc. The material can be trucked to work sites and stock-piled, avoiding the use of work trains, special equipment, and possibly train hauls from distant established producing plants. With the increased carrying capacity of trucks and trailers, it is now possible to transport large units of fabricated bridge steel, at least for short distances. This situation makes it possible to unload steel and other material from cars at the nearest siding, and to transport them to the work site without a work train.

Even the use of side-dump cars for hauling aggregate should be studied. It may prove cheaper to unload crushed stone, sand, etc., from cars at a nearby siding, with a crawler clamshell, and move it to the site of the work in dump trucks, than to use self-cleaning cars with a work train. Dump cars restrict the location of stock piles at the site of the work to points adjacent to the track, whereas, if the work site is accessible to trucks, the choice of stock pile locations is broadened, and the hours of productive work are not limited to the time that the unloading work train can remain at the work. Where two daylight shifts are employed, the use of work trains requires either two trains or excessive overtime for one train.

The use of a clamshell or derrick for unloading material from cars to trucks may facilitate car service, for in such cases the use of self-cleaning cars is not imperative, and gondolas may be substituted for flat cars where the length of the material handled permits this. The use of trucks where excavated material must be hauled away hardly needs comparison with the use of a work train and dump cars. Where trucks are used, the work can proceed without interruption, and there is practically no expense involved for the disposal of the excavated material.

The officer in charge of any project should study the possibilities of substituting trucks for other types of equipment, having in mind their many and varied uses, flexibility of operation, and continuous operation without the long idle periods experienced by on-track equipment. At the same time, improvement in on-track equipment, or the use of auxiliary machines to reduce the amount of time that on-track equipment is in use, should not be overlooked.

Many projects, where piles are to be driven in an embankment, are advanced by the use of earth augers prior to driving the piles. Such augers may be attached temporarily to pile driver leaders or operated separately as off-track equipment. This practice insures better vertical alinement of the piles and may obviate re-driving or construction of frame bents after embankment has been excavated.

Water-borne equipment, which includes pile drivers, dredges, power plants, etc., should not be overlooked where the project is so located that this type of equipment is economically available and its use practicable. Its use, however, is generally limited to navigable streams, canals, lakes and seaboard areas.

While the subject of this report seems to be circumscribed to include only the use of machines, we should not forget that the study of methods should include old fashioned, yet sometimes less expensive "main strength and awkwardness" procedures. Many times engineers have called out one or more wrecking derricks, with full crews of car men and one or two train and engine crews, to unload and place girders which could have been placed at less expense by hand methods, even though the latter might have required a few extra days.

Telephone communication over commercial lines has often enabled supervisors to keep in touch with work without depending upon conductor's work-train reports or the regular railroad circuits. On work where its importance justifies, a telephone should be installed so that the movement of off-track units of equipment can be directed and controlled. The use of railroad circuits should be discouraged. Many roads have labor agreements which restrict the use of company wires to regular operators, except in emergencies, and even then the roads may be required to pay for work not performed if their lines are used by other than operators.

Objections to Off-Track Units

There are objections to the use of off-track equipment, which must be given due consideration when planning methods of carrying out a project. All users of trucks and automobiles must have and pay for the various licenses required. These include truck or car licenses in each state in which they are operated, driver's licenses, ad valorem taxes, city licenses, liability insurance, etc. Off-track equipment, in some states, is also subject to inspection, with the accompanying fees that are not required for on-track equipment.

The use of off-track equipment does not mean necessarily that railroads should overstock such equipment, any more than that they should not purchase any off-track machines. Judgment must be used in the purchase of any equipment. Off-track machines are often available at reasonable rentals, with or without operators. Minor repairs can be made by the machine operators, and parts are usually readily available at nearby garages. A study of the methods employed by successful contractors is well worth the time of all railroad officers.

The present preparation of the country for defense has increased traffic density and shortened train schedules, and we can expect still further shortening of schedules. The use of locomotives, cars and other equipment has been intensified. The interference with revenue train movements by work trains and on-track equipment is more serious today than it has been in the past. Therefore, it is the duty of maintenance officers to overlook no factor which will enable operating officers to obtain their objectives in train performance.

To compare the costs of projects carried out by off-track and on-track equipment, completion report cost figures for the work done with one type of equipment must be compared with an estimate of the cost of doing the same work with the other type of equipment. Statistics, without a complete picture of a project, are often misleading. This should be borne in mind in this report, because the committee has accepted and incorporated statements of a number of individual members of the committee and other railway officers as to the economy of using off-track equipment, without specific supporting data.

It is the conclusion of the committee that the use of off-track equipment is not only possible, but that it is highly desirable and economical in many instances. Individual initiative on the part of officers will, in general, determine the scope of its use. In connection with the use of such equipment, the committee suggests that the following points be observed.

(1) Design structures and prepare plans and specifications that will invite the use of off-track equipment.

(2) Co-operate with manufacturers to improve machines and widen the scope of their use.

(3) Study and originate methods

of application of (a) existing off-track machines; and (b) the use of on-track machines to reduce the extent of their use.

(4) Do not use on-track equipment unless (a) it is warranted economically; unless (b) off-track equipment is not available; unless (c) emergency requires its use; and unless (d) the location and work forces its use.

(5) Select proper, competent and interested operators.

Committee—H. T. Livingston (chairman), engr. brdgs., C.R.I. & P., Chicago; D. T. Rintoul (vice-chairman), gen. bridge insp., S.P., San Francisco, Cal.; Van S. Brokaw, asst. engr., C.M.St.P. & P., Chicago; R. W. Cassidy, asst. cost engr., C. & O., Richmond, Va.; M. H. Dick, eastern editor, *Railway Engineering and Maintenance*, New York; Carl Djuvik, supv. brdgs., Tenn. Cent., Nashville, Tenn.; J. M. Giles, supv. b. & b., M. P., St. Louis, Mo.; F. W. Hillman, asst. engr. m. w., C. & N. W., Chicago; J. L. Holmes, supv. b. & b., M. P., Falls City, Neb.; A. S. Krefting, prin. asst. engr., M. St.P. & S.S.M., Minneapolis, Minn.; G. A. Linn, asst. supv. b. & b., C. & N. W., Huron, S. D.; C. D. Mallory, b. & b. fore., M. P., Piedmont, Mo.; F. S. Spofford, supv. b. & b., B. & M., Boston, Mass.; L. A. Warren, supv. b. & b., S. P., Sacramento, Cal.; B. M. Whitehouse, gen. brdg. insp., C. & N. W., Chicago; and M. H. Williams, engr. draftsman, D. & H., Carbondale, Pennsylvania.

Discussion

The discussion following the presentation of this report dwelt particularly on the importance of keeping slow orders to a minimum and the economies derived by the use of off-track equipment in eliminating the necessity for having unnecessary train service employees on the job. R. E. Caudle (M.P.) emphasized the importance of eliminating interference with train movements and keep-slow orders to a minimum and suggested that only one gang using on-track equipment which required slow orders, should be permitted on each subdivision, thereby limiting the number of slow orders required. He added that it was also the practice on his road to arrange the working hours on work requiring slow orders to those when trains were most infrequent, thereby interfering with traffic as little as possible.

Chairman Livingston commented favorably on Mr. Caudle's suggestions concerning slow orders but added that sometimes the amount of work to be completed on one subdivision during the season is so large that more than one slow order may be necessary to complete the work economically and within a reasonable time or during the working season.

L. D. Garis (C. & N. W.) referred to the fact that a conductor pilot was frequently required for the operation of on-track work equipment, although the requirements in regard to the use of train service men with such equipment frequently provides a surplus of men not needed or engaged in any productive work. He suggested that while the use of off-track equipment may be free at present of agreements requiring the use of trainmen in connection with its operating, such agreements may be demanded by the unions in the future, thus eliminating one of the principal economies which may be gained by the use of the off-track type of equipment.

That part of the report mentioning the desirability of correct design particularly impressed Armstrong Chinn (Alton), and he cited an instance which occurred on his road a number of years ago, in which, because of a lawsuit, a larger opening was required under a high fill. Former standards, he said, would have required a large concrete box culvert 160 ft. long which would have cost $35,000 and would have required slow orders during its construction. The problem was solved by jacking a corrugated iron pipe through the fill at a cost of $5,000, without any delays to trains. Mr. Chinn added that as expenses increased, production must be increased and suggested that greater use of off-track equipment should achieve this. He summarized the advantages of off-track equipment as follows: (1) It requires no expensive work train; (2) it eliminates the need for hiring extra non-productive train service employees in connection with its use; (3) it can work a greater proportion of the time than on-track equipment; (4) it does not interfere with train movements, and (5) it is frequently convertible so that it can be used for several types of work.

Railway Buildings in a Changing Age

By A. O. LAGERSTROM
Architect, C.M.St.P. & P., Chicago

EVERY modern going concern which sells to consumers, even including such bulwarks of conservatism as banks, knows, that to present itself to the public favorably, it must be attractive. We, as the designers of railroad structures, must fall in line with modern functional design. I emphasize the word functional, because many new and successful materials are available to us now, and their use should lead us into more modern, more practical and less wasteful design than we have practiced in the past.

For many years we have been building and designing heavy, enduring structures, and we may well be proud of them, because they have stood the test of time and have been able to take care of increased traffic. Today, to a large extent, we can reduce weight and build just as strongly.

Recent developments in methods have brought to light uses and advantages in our usual structural materials that we never suspected as recently as five years ago. Today, modern design has given these old materials a new lease on life, and we must be able to incorporate them in our conception, along with new materials. Not only this, but today we have learned, unfortunately the hard way, that through the application of modern design and materials, we can fit our buildings in with local settings. Of course, discretion must be used in this regard. Too often in the past, to the detriment of the communities in which we have tried to instill a pride in their railroad facilities, we have designed without regard for their local backgrounds. This policy did not invite revenue or respect from patrons.

Builders' Dreams Come True

Today, as the result of scientific research and the development of new tools and materials, the dreams of building men have largely come true. Are we taking advantage of these developments? Are we using them as efficiently as other modern industries are? Unfortunately, it has been much easier to get our competitors, the air and bus lines, interested in merchandising through appeal in their structures and facilities, than it has been to interest railway officers, who have lived with their structures so long. It is really remark-

able how we have been able to compete with our competitors as well as we have, in the face of their new facilities, incorporating the last word in appeal and service.

We building men on the railways know all the requisites of our jobs. We are specialists and so are our superior officers. We do not need the assistance of outside specialists for many of our detailed design problems, but it is true that such specialists, with a general "birdseye view" of all transportation requisites, can be of great help in aiding railway managements in visualizing the importance of modern architecture in their more important stations, and the part that their building departments must play in this regard if we want to "Keep up with the Jones's."

Welding in Water Service

Report of Committee

J. P. Hanley
Chairman

ONE of the outstanding developments in labor-saving devices and methods of doing work on the railways in recent years has been the extended use of oxy-acetylene and electric-arc welding in the mechanical and maintenance of way departments. Through the research of the metallurgist, the fusion and adhesive qualities of metals and alloys have been under constant study, while at the same time the design of welded joints and the methods and technic of welding have shown consistent improvement. The practical application of welding has been receiving engineering study on the railways recently to widen its use, and this study has developed methods for bringing various types of welding work under standardized control and costs.

Early Development

Like many other widely-used inventions, the beginning of welding was of humble origin, and its development was a step-by-step process. Oxy-acetylene welding may be said to have been discovered in France in 1895, when it was found by a French chemist that the combustion of oxygen and acetylene combined produced a flame of unusually high temperature. In the same year a machine was developed in Germany for the production of oxygen from liquid air. In 1901, the blow pipe was developed in France for combining and burning oxygen and acetylene. These three basic factors in welding were developed and improved for the most part, by separate companies in Europe and the United States. Many small companies, in turn, have been merged into a limited number of large corporations, which now develop, manufacture, sell, lend and lease a wide assortment of welding materials to the railways and others users. The advent of the World war in 1914 increased immensely the use of welding for the repair and construction of war equipment. After the war, industry took up the use of welding extensively for the repairs, and also for the manufacture, of many products.

The use of welding on the railways started in the mechanical shops, and has now been extended to all branches and divisions. Indicative of its now general use is the amount of oxygen and acetylene gas purchased by one mid-western railway (with approximately 6800 miles of lines) during the calendar year 1940, which included 23,781,900 cu. ft. of oxygen gas and 9,351,018 cu. ft. of acetylene gas. Of this amount, 4,832,100 cu. ft. of the acetylene gas was generated at the point of use, while the balance of both gases were received in cylinders and used at points ranging from small isolated jobs to medium size shops. Water service repairmen frequently use one cylinder of each gas, which they transport from job to job in their trucks or automobiles. They also usually have an oxy-acetylene welding outfit on their camp and tool cars. This equipment offers decided economy in removing old piping and in installing and repairing new facilities.

It is regrettable that the water service department was about the last department on the railways to adopt this modern process, but the replies to a questionnaire by your committee indicate that the majority of the water service departments now use welding equipment, and that their men are becoming competent in its use for the purpose required. Welding in the water service field is not of the complicated or highly expert type. The equipment is generally used in joining and cutting wrought pipe, in melting lead joints in cast iron pipe, in repairing castings, and in thawing frozen water lines.

Information and suggestions submitted by committee members regarding water service welding practices on the several railways with which they are personally familiar, are presented in the following statements. In these statements, the railways have been designated alphabetically, but their names, as well as the names of the committee members who furnished the information concerning them, may be secured if further details are desired by members of the association.

Road "A" Sees Advantages

A portable oxy-acetylene welding outfit should be furnished each water service gang. There may be isolated locations where electric welding may be resorted to, but such welding is usually of a special nature.

On this road, oxy-acetylene welding is used almost exclusively for making repairs to pipe lines in yard distribution systems of air, steam and water, and for similar repairs in shop and roundhouse systems of hot and cold water, steam, air and blow-down and boiler washing lines. It is also used for general repairs to power-house lines. Welding is also resorted to for the installation and repair of manifolds, headers, exhaust heads, separators, exhaust tank heaters and radiators, sand pipes and fittings, stove and furnace stacks, blower lines, hand rails, coaling station facilities and equipment, and for many other classes of work. No attempt, other than for emergencies, is made to weld pipes or tubes of a diameter less than ¾ in.

For new work around terminals, beveled-end pipes and fittings are ordered, ready for welding. This gen-

erally does away with unions, which are a source of trouble. Welded connections simplify repairs and reduce friction. Pipe work located at points away from terminals is not welded as yet, except for repairs.

The advantages of welding by water service gangs are many. Reductions, bends, tees, ells and branch connections can be welded in place more satisfactorily, and in about half the time required for screw connections. In repairing a leaky joint, a short piece of pipe can be spliced into the pipe and welded, making a secure and rigid job.

Trenches do not have to be as wide at joints or connections for welding as they do where pipe tools must be used. Tunnels that will admit a man will usually permit welding, and welded pipe takes up less room and slides through a conduit more easily.

At locations where vibration exists, it is found that welded joints, fittings and connections are much less likely to leak than screw connections. Usually too, unions can be eliminated, and welding produces a neater job.

The welding of pipes, tubes and fittings for both new and repair work is generally recommended in large terminals, yards and power houses. There is still a place for screw joints for small installations and for small pipes and exposed plumbing fixtures.

Pipe installations in buildings should be welded in sections on the ground and the sections then hoisted and welded in place. Scaffolds and tackles should be strong and well designed. With careful planning, pipe work of pleasing appearance can be installed safely and economically.

Road "B" Does Little Welding

Water service maintenance men on this railroad have definite territories to cover. Individual maintenance jobs are usually handled by one man. The majority of the territories are outside the large terminals, where the bulk of the pipe work is underground. No welding outfits are assigned to maintainers, and few have had experience in operating welding equipment except for thawing pipe lines. Welding equipment is not assigned to the water service organization.

Pipe maintenance work above ground in the larger terminals is handled by mechanical department forces, who have done considerable pipe welding work during the last few years. While no figures are available to verify the statement, it is felt certain that substantial economies have been effected as a result of pipe welding at shops and roundhouses.

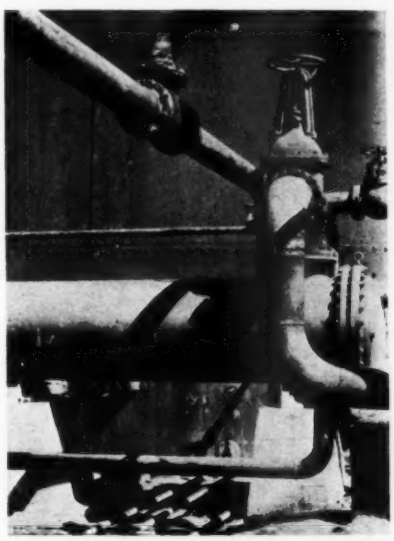
On existing water facilities, where cast iron pipe has been used there is little opportunity to do maintenance work with welding equipment. Field-welded pipe should be given consideration when new pipe lines are being planned, with the view to the most economical maintenance of these lines.

There are instances where items of equipment can be repaired more satisfactorily by welding, but these instances are so few that it appears more economical to have such done by a local welder as it arises, than to wait to have the work done by company-owned welding equipment, which might not be readily available.

It is believed that insufficient welding is required in water service work outside of terminals to warrant the purchase of welding equipment and the expense of training water service maintenance men in welding work. Water service men should, however, have a general knowledge of the uses of welding, as applied to their respective needs.

Road "C" Makes Extensive Use

All of our pipe fitters, plumbers and water service men, and their helpers, have taken up the study of welding, and practically all of them are good welders. These men were given opportunity to learn the handling of the cutting and burning torches, were supplied with literature covering this equipment, and were instructed in the art of welding by instructors furnished by the service company which maintains an organization in this vicinity. Almost any good water service man or plumber can, in a short period of time and with a limited amount of training, become sufficiently skilled to do the ordinary pipe welding encountered in general water service work.



The Welded Fittings in This Pipe Line Installation Provided Certain Practical Advantages and Effected Substantial Economies

More welded joints are used in our pipe lines than old style threaded joints, and welding is performed wherever possible in preference to threaded joints, as it makes a better job, with less likelihood of leaks. Several extensive jobs have been completed with all-welded joints, elbows and connections. In some cases, special welding elbows, tube turns and flanges are used, and the pipe is purchased with V'd ends, ready for welding. In other cases we make the elbows, tees and fittings, especially in the small pipe sizes.

Advantages

One of the advantages of welded pipe lines is the ease with which a connection can be made to an existing line. Instead of cutting, threading and installing unions or flanges, a hole of the required size can be burned in the main and a welding nipple inserted with a valve on the end. As soon as this piece is welded in place, the main line can be restored to service.

In all connections of this character, a saving is made not only in time and material, but also in the time that the main line is out of service. Welded connections have been made to a 2-in. steam line enclosed in a box conduit, at a cost of 70 cents for labor and material. In this case, it would have been impossible to cut and thread the pipe in the usual manner without disconnecting the pipe and removing the encasement. In making connections to existing water lines in cramped quarters underground or overhead, the welding method is a time and labor saver, not only reducing the time formerly spent in cutting and threading pipe, but also on excavations, staging and incidental work.

At an isolated point on a branch line, a tank was supplied from a water ram which had been in service for 30 years. The main body casting of the ram broke in two while in service, putting the water supply out of service. The ram was disconnected, brought into headquarters by truck and was welded by one of our pipe fitters. The cost of the repair work was $19.70, as compared with a cost of $55.30 for a new repair part. In addition, a delivery delay of several weeks was avoided.

Welded lines can be bent around floor beams, posts and roof rafters without special elbows, flanges or unions. This effects savings in labor and material and permits installations where screwed or flanged pipe cannot be used on account of lack of working space. A welded line has a

much better appearance than a screwed or flanged line, as it is practically the same size throughout, permitting covering without unsightly bulges over threaded connections.

No special organization is set up for ordinary bridge and building work, except that tools and welding apparatus are made available for each man. A grinder for making V-joints would cut the cost of preparing materials for welding, but in most cases this has to be done by hand, particularly where the lines are overhead, underground, or in cramped quarters. For large installations which can be programmed for a specified time, the use of power grinders and cutters should be considered, and the crews that are to do the work should be organized and trained.

Outfit For Each Gang

A welding outfit should be made available for each water service man for use on the line, and another should be furnished for shop pipe fitters. All divisions on this road are equipped with acetylene welding outfits, but the men are not familiar with electric arc welding. Cutting with the torch, particularly if the old line is to be scrapped, can be done in a fraction of the time required to uncouple and remove a line in the ordinary way. Lines can be cut into short lengths for easy handling.

Blow pipes and regulators are supplied by the service company while the hose and tips are furnished by the railway. The outfits are serviced by the company supplying them, which also provides instructors to supervise special jobs and to instruct employees in case they have a job requiring expert advice.

Cost of Outfits

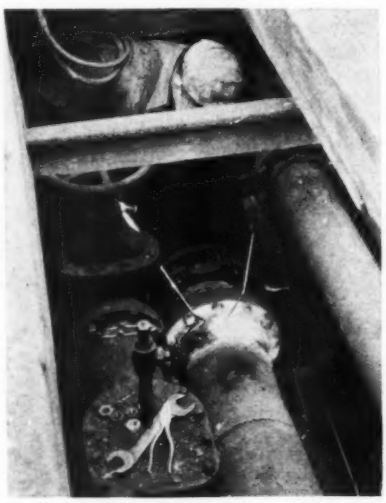
In addition to the cutting and welding blow pipes, regulators and adaptors which are supplied by the service companies free of charge, the following items, with their approximate cost, are required to be furnished by the railway.

100 ft. of hose, couplings and clamps	$19.06
1 Pyro lighter	.26
1 pair welders goggles	2.10
1 pair welders gloves	.75
6 welding tips	31.77
1 gas cylinder wagon	10.00
	$63.94

This provides an outfit that will take care of practically all ordinary bridge and building and water service work.

On this division, water service men and pipe fitters do a considerable amount of welding other than on pipe for water service, and many jobs that are handled ordinarily by the bridge and building department, both in terminals and on the line, including repairs to machinery, equipment, coaling plants and turn-tables, are taken care of by these men. On a large welding job, acetylene gas can be generated at the site of the work by the use of generators offered by any of the concerns catering to this trade. Gas generated in this manner costs less than that furnished in cylinders.

In repair work by welding, or in making connections to existing lines, operators can work in very small and cramped quarters, if necessary, and can burn a hole in a pipe line and weld in a connection where it would be impossible to make the ordinary screwed connection. Practically all pipe work in roundhouses, stations and greenhouses for both steam and water is carried on by welding. It saves time, labor and expensive parts, and makes possible pipe connections which could not be made in the usual manner.



Welders Can Work in Very Small and Cramped Quarters, As Is Indicated By the Welding Being Done in This Pipe Tunnel

A recent job consisted of the installation of a 10-in. high-pressure valve in a steam line extending from a roundhouse power room. A short section of the main was removed with the cutting torch and the valve welded in place in four hours by a welder and a helper. This eliminated the expense of machine-cutting and threading the 10-in. pipe, which was located near the ceiling of the power room, and also the use of two 10-in. flanges and gaskets, and restored the line to use much more quickly than would have been possible if the valve had been installed by threading and flanging in the line.

From experience, it is found that the practice of welding pipes in water service work is much superior to the old method, and is bound to increase as its advantages become better known.

Road "D" Has No Specialized Welders

Specialized welders are not employed as a rule and welding is carried on by different members of the bridge and building department who have received some training. It is believed that considerably better results could be obtained if all welding was done by a trained welder, and on parts of the road this practice is followed with good results. On other parts of the road, electric arc welding has been used to advantage.

Welding in water service is of advantage in saving time and in reducing the number and type of fittings required, and the completed work generally has a better appearance than screwed or flanged joints. In removing old piping and equipment, the acetylene torch saves time, particularly in places that are hard to get at. Where the material is to be scrapped, the acetylene torch is especially preferable to disconnecting.

The acetylene torch is found useful on steam and water lines in conduit boxes, where the pipe is split or where a small hole is causing a leak. It saves the work of removing the pipe, and, if a reasonable opening is provided in the conduit, no unfavorable reaction is caused by the fumes.

Where the quantity of work to be done is sufficient, a trained welder is of advantage, but where the work in the territory is so small that a trained welder cannot be employed continuously, it is better to continue with the screw or flange-type joints. Water service maintainers become fairly proficient in welding if the amount of welding done is sufficient to keep them in practice, but if the work is intermittent, they do not maintain proficiency.

11 Divisions on Road "E" Are Equipped for Welding

The water service department of this railway has 12 division gangs and one system gang. Eleven divisions use welding in water service work and have one or more oxy-acetylene outfits in their gangs. One division also uses an electric welder for shop work and cast-iron welding, and for thawing frozen service lines. The system gang uses the oxy-acetylene process and puts it to a great many uses, including welding and cutting wrought and steel pipe; brazing and repairing well screens, well casings and drop lines; and salvaging and repairing valves and fittings. A considerable number of the personnel of the system gang and of the division

gangs have become competent in welding and cutting, and the balance of the men are very much interested in the process and are practicing to become competent whenever they have opportunities. The supervisory officers encourage and assist those repairmen who show interest.

Find Valuable on Road "F"

Acetylene welding has many advantages in water service. On my territory on 225 miles, the men would be stranded at times without a welding outfit. As the result of welding, one-third of the fittings used 15 years ago are no longer required, which is a large factor in economical water service maintenance. Welding is used for all kinds of repair work, including castings, aluminum, brass and copper.

In installing valves, large and small, in wrought piping, the valve is fitted with short nipples; a section of the line is cut out; and the valve assembly is then welded in place. Water column castings are repaired without taking the column out of service. In fact, anything that breaks in water service is repaired at a generally lower cost than the cost of repair parts.

The acetylene torch is 100 per cent useful in removing and cutting down old pipe systems and in salvaging and repairing second-hand valves and fittings for future use. The welding torch can be used successfully in pipe tunnels and other cramped locations. In these places, if no draft prevails, a fan should be set up behind the welder to furnish air circulation for removing the fumes and for providing fresh air. Welding should not be done on the inside of sooty smokestacks, as the soot may explode when heated. The acetylene valve should not be turned on in closed places. The torch should be lighted before entering. All water service men should be good welders as they cannot handle their work economically at the present time without using this process.

Electric Arc Welding

The use of the electric arc in welding has been known for more than 50 years. The original patent was granted in Russia in 1887. This patent covered the carbon electrode process. The patent for the metallic electrode process was granted in 1889. The industrial world was slow to develop the possibilities of electric welding until the World War demonstrated its usefulness in the maintenance and repair of military equipment. The great expansion of industry after the war gave electric arc welding a vast field for use in the maintenance and repair, and also the manufacture, of many industrial items. The use of the covered electrode welding rod made possible a distinct improvement in the application and speed of depositing the fusing metal. The discovery that this process permitted the economical welding of such metals as manganese and cast iron also increased its use.

The use of electric welding is increasing in the maintenance of way departments of railways for repairing manganese frogs and crossings in place. The water service department of one railway reports the use of a mobile electric unit for thawing frozen service pipes. Another road uses this type of welding for repairing damaged sections of cast iron heating furnaces without their removal.

One mid-western railway has 17 electric welding outfits in its maintenance of way department. These outfits are operated by gasoline engines, or electric motors, as conditions require, and are skid, truck or tractor mounted, depending upon their location. An outfit of the 40-50 h.p., heavy-tractor-mounted type, having a 300-ampere welding current, was purchased recently at a cost of $3,342.

Some of the smaller welding outfits owned by the railway referred to are located in the division work-equipment shops, and the mechanic in charge performs a community electric welding service for the various subdepartments, including the water service and bridge and building departments, in addition to maintaining the maintenance of way track equipment.

This arrangement results advantageously to the water service department, which may thus have many kinds of castings repaired by electric welding, where this type of welding is superior to the acetylene process.

Conclusions

(1) Welding is now generally recognized as a necessary process in water service, as well as in other departments of the railways, and equipment and training are being supplied to water service men by most roads.

(2) Acetylene welding outfits are much more numerous than electric welding outfits, although water service men can usually obtain the advantage of the latter form of welding by taking their work to the division maintenance of way and mechanical shops.

(3) In some instances, portable electrical welding outfits are being used by water service men for thawing frozen water pipes and for welding heating-furnace and other castings without their removal.

(4) The greatest use of welding outfits is in welding and cutting wrought pipe, in melting lead joints in cast iron pipe, and in improvising alternate arrangements where standard fittings are not on hand.

(5) It is recommended that welding outfits be supplied to water service men where outfits are not now available, and that supervisory officers make arrangements to supply the necessary training to the men and to otherwise encourage them to become proficient welders to such extent as is useful in water service work.

Committee—J. P. Hanley (chairman), w. s. insp., I. C., Chicago; G. S. Crites (vice-chairman), div. engr., B. & O., Punxsutawney, Pa.; M. A. Bost, asst. engr., C.M.St. P. & P., Mason City, Ia.; J. Cole, fore. w. s., C.N.R., Toronto, Ont.; L. A. Cowsert, w. insp., B. & O., Dayton, Ohio; C. S. Crippen, fuel insp., C.M.St.P. & P., Chicago; L. D. Garis, asst. gen. br. insp., C. & N. W., Chicago; F. M. Ginter, fore. w. s., Alton, Bloomington, Ill.; J. A. Jorlett, asst. mast. carp., Penna., Jersey City, N. J.; W. Liechti, engr. draftsman, C. & N. W., Chicago; J. H. McClure, b. & b. master, C.N.R., Moncton, N. B.; K. L. Miner, supv. b. & b., N.Y.C., Albany, N. Y.; R. T. Rumboldt, supv. b. & b., Sou., Greensboro, N. C.; T. J. Sheehy, supv. w.s. & p., D. & H., Plattsburg, N. Y.; G. L. Summers, w.s. repairman, M. P., Bismark, Mo.; J. L. Varker, supv. b. & b., D. & H., Carbondale, Pa.; M. P. Walden, asst. supv. b. & b., L. & N., Evansville, Ind.; W. L. Wallace, supv. w. s., P. M., Saginaw, Mich.; and K. J. Weir, spl. w. insp., C.M. St.P. & P., Chicago.

Discussion

While the report did not discuss the conservation of materials, G. S. Crites (B. & O.) cited recent examples of changes in water stations where new pipe could not be obtained and indicated that in many instances welding can be employed successfully for this purpose. One example dealt with an emergency need for a 3-in. water line 2,500 ft. long, for which new material could not be obtained. This emergency was met by welding old boiler flues into 500-ft. lengths and placing them into the trench. Mr. Crites also referred to the objection on the part of certain railway officers to the use of oxy-acetylene welding in shops, enginehouses and coaling plants because of the risk of fire, and suggested that where such risk does exist, a fire extinguisher should be moved to a point adjacent to the welder, where it will be available immediately in case of need.

The use of welding to conserve materials was also emphasized by A. Chinn (Alton) who said that numerous examples had been brought to his attention in which welding has extended the life of material, where care had been used to repair rather than cut out sections of lines that were in need of attention.

Recent Developments in Paint Removal

Report of Committee

FACED with the general revival of painting programs, after a lean decade characterized by a tremendous accumulation of deferred painting maintenance, the adequate removal of old films, the proper cleaning and preparation of surfaces as well as the application of suitable protective coatings are now of the utmost importance to maintenance officers. Consistent with the time which is available on this occasion, it is the object of this report to present a general summary of the methods, equipment and tools which are now available for the removal of old paint and rust films and for the preparation of the surfaces of steel structures and buildings. In an effort to present a representative summary of the current practices of American railways in this respect, this report is based upon data secured from 33 different railways, having 206,694 miles of lines or more than 70 per cent of the total line mileage of both the United States and Canada.

The outstanding developments in the cleaning and protection of steel surfaces during the last few years include the recent introduction and development of the flame-cleaning process and a marked expansion in the use of pneumatic cleaning tools as well as the use of petroleum products and compounds containing rust-inhibiting chemicals. However while the term "flame-cleaning" is in itself a descriptive nomenclature which readily classifies the process as a cleaning and dehydrating agency, the use of petroleum products involves other considerations, including protective coatings or the removal of rust or both.

Apart from flame-cleaning, and the expanded use of pneumatic tools and petroleum products as well as minor changes in tools and equipment which have increased the efficiency of pneumatic cleaning tools and sand blasting methods, no other marked changes are evident in the preparation of steel surfaces prior to repainting or recoating. The detailed descriptions of the tools, apparatus, materials and methods contained in a report entitled Cleaning Steel Bridges Preparatory to Repainting, presented at the 1935 convention of our association, still apply largely to the programs of today.

Insofar as wooden buildings are concerned, no marked difference is apparent in the methods used for paint removal and the preparation of both exterior and interior surfaces during the last five years. Except for an expanding use of torches and burning outfits, particularly those of the propane type, the detailed data, included in a report entitled The Inspection and Preparation of Wood Surfaces for Painting, which forms a part of the proceedings of this association for 1938, are still applicable in large measure to this type of work.

C. Miles Burpee
Chairman

Hand Cleaning

While the tools and methods in general use for the hand cleaning of steel structures have not changed to any appreciable extent during the last 10 years, replies from 33 railways, representing a grand total of 206,694 miles of lines, show that 21 roads with 135,166 miles of lines, or 65 per cent of the total, now use hand cleaning methods for 50 per cent or more of their annual painting programs for steel bridges and structures. Four roads, with a combined mileage of 34,582 miles of lines, utilize hand methods almost exclusively, reporting that from 99½ to 100 per cent of their cleaning is done in this manner. Eight roads, with 69,610 miles of lines, use hand cleaning for 75 to 90 per cent of their programs, and while five others, with 13,971 miles of lines, did not state the extent to which hand cleaning is used, their replies indicate its general use; from 50 to 74 per cent of the cleaning of steel surfaces is carried on by similar means on four other railways whose combined mileage totals 17,003.

In commenting on the cleaning of steel structures, the engineer of bridges of a large railway which employs hand cleaning methods for a large proportion of this work, states: "In most cases cleaning by means of wire brushes and scrapers is all that is required. The removal of existing firmly-attached paint is not considered necessary. When there is extensive scale to be removed, pneumatic chipping hammers facilitate the work."

Pneumatic Tools

Pneumatic tools in general use for cleaning steel surfaces consist of rotary wire brushes, chipping and scaling hammers and scaling tools. Their detailed descriptions and methods of use have already been presented to the Association and are to be found in recent issues of the Proceedings. Our survey shows that 25 railways, comprising 154,886 miles of lines, or almost 75 per cent of the total mileage reporting, are using pneumatic tools and that nine of these roads, representing 19 per cent of the total mileage reporting, are using pneumatic tools for 50 per cent or more of their steel cleaning programs. Of these, two roads, with a total of 11,643 miles of lines, reported that pneumatic tools are used for 75 to 95 per cent of their steel cleaning programs. Seven other roads, comprising 27,806 miles of lines, use pneumatic cleaning tools on 50 to 74 per cent of their work. Two roads with combined mileages of 20,737 miles of lines, representing 10 per cent of the total mileage surveyed, utilize pneumatic cleaning tools for 25 to 49 per cent of their steel cleaning work, while five others, representing almost 9 per cent of the mileage reporting, do from 5 to 24 per cent of their cleaning in the same manner.

In addition to the statistics already presented, nine other roads totaling 76,684 miles of lines reported the employment of pneumatic tools but did not specify the extent of their use.

A southern railway reports that usually when steel structures have been repainted on four successive occasions it is necessary to remove the old paint down to bare metal, and that pneumatic tools are used for that purpose. Rust is removed by pneumatic scaling tools and it is found advantageous to follow this process by cleaning the bottom of rust pits with oxy-acetylene flames. This road has also established a practice of applying a coating of fuel oil to facilitate the

cleaning of rusted, horizontal surfaces, such as the tops of girders and stringers; after three or four days the rust is removed by means of pneumatic scaling tools or hand scrapers.

Another large system reports that while extensive scale is removed by pneumatic chipping hammers and that while rotary wire brushes are quite effective, their use is considered hazardous, due to the breaking of wires when the brushes are operated at high speed.

In considering the comparative efficiency of cleaning methods, as practiced by one railway which maintains detailed records of cleaning and painting and which employs pneumatic tools for 66 per cent of its steel cleaning and hand methods for 33 per cent, the engineer maintenance of way submitted the following data on hand cleaning versus pneumatic tools.

Comparative Cost Data, Hand Cleaning Versus Pneumatic Tools

	Hand Cleaning	Pneumatic Tools
Cleaning cost per ton	$1.12	$1.45
Painting cost per ton	$1.10	$1.90
Total labor cost per ton	$2.22	$3.35
Gallons of paint per ton	0.53	0.81
Cleaning cost per gallon of paint	$2.12	$1.79
Painting cost per gallon of paint	$2.08	$2.35
Total labor cost per gallon of paint	$4.20	$4.14
Ratio, cleaning to painting	1.02	0.76

Continuing his comments, this maintenance officer adds the following interpretation of these data in demonstrating the efficiency of these cleaning and painting methods:

"It will be noted from these figures that whereas the cost per ton is higher for pneumatic tools than for hand cleaning, the cleaning cost per gallon of paint applied is lower for pneumatic tools. The higher cost of applying paint after pneumatic cleaning indicates that a greater percentage of primer is applied and in more inaccessible places. The greater number of gallons per ton indicates the same thing."

Sand Blasting

Sixteen railways, representing 116,260 miles of lines, or 56 per cent of the total line mileage under consideration, reported the use of sand blasting for cleaning steel surfaces. The extent of its use varies from occasional practice to general use on one of the southwestern roads, although in this instance no specific proportion to the general steel cleaning program is mentioned. A southern road uses sand blasting for 30 per cent of its cleaning and two other railways employ this method for 15 to 20 per cent of their cleaning work. While in the opinion of a large proportion of railway maintenance officers, sand blasting produces most efficient results insofar as the cleaning of steel surfaces is concerned, the high cost of operation is cited as the predominant reason for its comparatively restricted use.

Flame-Cleaning Steel Structures

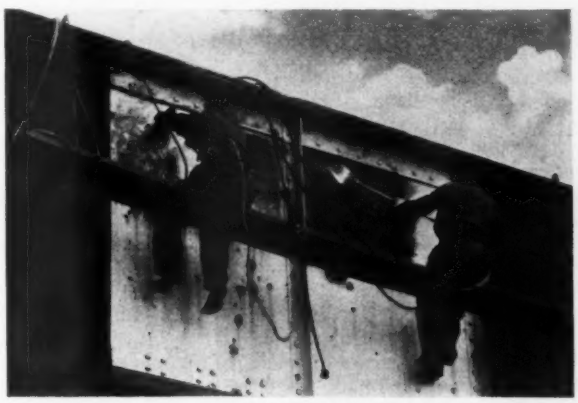
While the American Society for Testing Materials revealed certain advantages to be gained from the use of flames in preparing steel surfaces for painting, more than 20 years ago, it was not until 1936 that a practical method was developed. Ensuing progress has reached the point where the oxy-acetylene flame is now widely accepted for the descaling of billets, castings and forgings and more recently for the flame-cleaning and dehydrating of steel surfaces prior to applying paint and protective coatings.

In addition to removing loose scale and rust, the oxy-acetylene flame-cleaning process is designed to improve the surface to be painted as well as the conditions under which the protective coating is to be applied. Moisture is driven from the surface, leaving it warm and dry and the heat also prevents recondensation. The application of paint to the warm surface produces a thinning effect on the paint and lowers its surface tension, which imparts a wetting action and aids the paint in penetrating cracks, crevices and porous scale. In instances where the paint is brushed, it is claimed that the warmth makes for easier application and faster setting qualities.

Flame-cleaning structural steel is accomplished by the use of specially-designed burners which are passed over the surfaces to be cleaned in such manner as to subject surface scale to intense, high-temperature flames. In the resulting action, the surface layer is raised to a high temperature which sets up stresses within the layer, causing it to expand and to free itself from the underlying cool, brittle layers before the steel is warmed enough to expand appreciably. Although some of the tightly adherent oxide scale, particularly on newly fabricated work, withstands the action of the flame, it is usually so tightly affixed that it protects the steel from corrosion and forms a good base for prime coats.

The application of the flame is followed in from 5 to 15 minutes by thorough wire brushing, using either pneumatic or hand brushes to remove any partially free scale, dirt, or rust. The fine dust, which usually remains after wire brushing, should be removed prior to the application of paint and old paint brushes serve as good dusters for this purpose. The cleaned surfaces should be painted before they reach the temperature of the surrounding air and while the time interval varies, it should not exceed two hours. When closing up work at the end of the day, the entire process should be so governed that all cleaned areas will be coated in order to prevent oxidation of cleaned surfaces and to preclude the necessity for a second cleaning operation on the following day.

In addition to the usual equipment that is necessary in the use of oxy-acetylene flames, the principal item required for flame-cleaning is the special heating head. While some specifications prescribe the size and type of heads or burners for various applications, experience has shown that such requirements sometimes are unnecessarily restrictive. Various sizes and types of heads are in use, including flat and round tops. The former usually vary in width from 2 to 12 in., of which the 6-in. width seems well adapted to general use. The flame ports are about 0.020 inch in diameter and are spaced about ⅛-in. apart.



Many Roads Are Finding Flame-Cleaning With the Oxy-Acetylene Torch to Be a Highly Effective Method

Petroleum Products and Compounds Containing Rust-Inhibiting Chemicals Are Being Used Extensively

Two end skids, provided for use on flat surfaces, space the head at the proper distance from the surface and serve as guides in the cleaning operation. Round heads or tips having hard-faced wearing rings are also available for cleaning rivet heads, fittings, corners and other projections. While for ordinary work the head or tip is attached to the blowpipe directly, extension arms are available for reaching more inaccessible surfaces.

Although the practical development of flame-cleaning structural steel is of such recent origin, the process has already been used by no less than 15 of the railways which were canvassed, representing 110,764 miles of lines, or the equivalent of more than 53 per cent of the total line mileage covered by this report. Five of these railways, representing 25,611 miles of lines, or 12 per cent of the total mileage covered, are using flame-cleaning to an extent ranging from 2 to 12 per cent of their total cleaning. The 10 remaining railways within this category, did not specify the extent to which flame-cleaning is being employed; however, they represent 85,153 miles of lines or slightly more than 41 per cent of the total mileage covered by replies to the questionnaire.

By reason of the fact that the adoption of flame-cleaning is of such recent origin and that its use for cleaning railway steel structures has been comparatively limited, representatives of the roads which are using this procedure are reticent in expressing their opinions. However, the engineer of bridges of one large system now believes that it is apparently just as efficient as sand blasting and the cost is considerably less. The assistant chief engineer of another road declared that after using flame-cleaning to some extent for more than two years, he has found it very efficient for the removal of heavy deposits of grease, dirt and rust from rail troughs and heavy deposits of rust scale from floor beams and girders.

An interesting experiment was reported by one of the committee members, a representative of a large railroad which uses hand cleaning methods for practically all of its steel structures. Eleven spans of 25-ft. lattice beams supporting a trainshed roof were cleaned of all loose scale and coated with an oil preservative. Six months later it was found that corrosion had not been checked effectively and the steel work was cleaned again prior to repainting. Both flame-cleaning and hand methods were used in the second experiment and accurate records were maintained. Flame-cleaning required 13 man hours and the total cleaning cost of labor and material amounted to $17.50 per beam. Hand cleaning methods required 26.1 man hours and the labor cost amounted to $18.27 per beam. In hand cleaning, an effort was made to duplicate the results of the flame-cleaning process by cleaning the entire surface area of each beam. Comparative results favored the flame-cleaning process in both appearance and cost of the finished work.

The Use of Petroleum Products

Among the developments of the last decade has been the trend toward the use of petroleum products and compounds containing rust-inhibiting chemicals as a means of reducing maintenance expense and at the same time providing protection for steel structures. Although one of the railways answering our questionnaire has used petroleum oil to a small extent for such purposes during the last 30 years and while a second has employed similar means of protection for 15 years, it is only within the last 9 years that the use of petroleum oils and compounds impregnated with rust inhibitors have come into widespread use.

During that prolonged period when operating revenues receded to such extent that the curtailment of maintenance expenditures assumed a perennial character, maintenance officers were faced with serious and perplexing problems centering around the adequate protection of steel structures. It was during that period that one road after another adopted the use of petroleum products of some form, chiefly as an expedient in retarding corrosion and with the intention of carrying the structures through a period marked by drastically curtailed painting programs. In many instances the petroleum products were applied directly to corroded surfaces, without preliminary cleaning, thus eliminating a comparatively large item of expense and, since material costs were low and much of the application was made by spraying, the procedure offered temporary relief at least and at a cost commensurate with the limited funds which were available.

By the summer of 1935, the general use of petroleum products and compounds for the protection of steel surfaces was still in the experimental stage. However the movement had assumed such proportions that the matter received detailed attention in the committee report on Cleaning Steel Bridges Preparatory to Repainting, which was presented at the 1935 convention of our Association. Moreover, that report stated that one road had adopted the use of such products as standard practice and had discontinued cleaning rust from steel bridges prior to recoating, while the bridge engineer of a second road had decided to follow a similar procedure and that a third road was using a non-volatile penetrating oil successfully for similar purposes.

Of the 33 railways which replied to our questionnaire, 22 roads with a combined mileage of 151,513 miles of lines, equivalent to 73 per cent of the total line mileage of this survey, reported the use of petroleum compounds and products for the protection of steel structures. Six of these roads, representing 28 per cent of the mileage of all roads reporting, use these products extensively; in fact, one road declared that very little cleaning of steel structures is necessary since practically all are coated periodically with an asphalt base oil. Another of this group uses petroleum compounds and products for 60 to 75 per cent of its painting program, still another uses products of this nature for 50 per cent of its steel painting program, while the three others within the same group report general use.

Eleven railways, comprising the second group within this category, have a total line mileage of 64,474, representing 31 per cent of the total line mileage for all roads reporting. Nine roads within this group do not

specify the extent to which petroleum compounds and products are used for steel protection; of the others, one uses such products for 10 per cent of its steel painting program and the remaining road uses a petroleum compound for 5 per cent of its work.

In addition to the groups already described, five other roads, with 29,309 miles of lines, or 14 per cent of the line mileage of all reporting railways, are conducting field tests with various petroleum compounds and products for the protection of steel structures. On the other hand, two other railways with a total of 6,734 miles of lines report that after using certain petroleum products they were dissatisfied with the results and have discontinued their use.

Cost of Cleaning Steel

Any extended study of the comparative costs of cleaning steel structures necessarily involves so many variables that the results are of doubtful value. However the data furnished this committee, during the course of its survey, present some features which are worthy of consideration. For instance, of the 33 railways reporting, 14 roads with 69,390 miles of lines or only about one-third of the total line mileage covered, maintain cost records of cleaning steel structures. Of the four roads who do from 99½ to 100 per cent of their cleaning by hand, only one maintains a cost record and while 17 others do from 50 to 90 per cent of their cleaning in the same way, only eight of these, comprising considerably less than half the mileage of this group, maintain cost records.

On the other hand, among the 25 railways reporting the use of pneumatic cleaning tools, the proportion of the roads which maintain cost records is considerably higher. For instance, both roads using this method for 75 to 95 per cent of their cleaning keep cost records, while the same is true of four roads out of seven others which use pneumatic cleaning tools for 50 to 74 per cent of their cleaning. Considering those nine railways, with 39,449 miles of lines, which report the use of pneumatic tools for 50 to 95 per cent of their cleaning, six of them with two-thirds of the group mileage maintain regular cost records.

Of the 16 railways reporting the use of sand blasting, seven, with 37 per cent of the line mileage within the group, reported the use of cost records. Three of these roads, which employ this method for 15 to 30 per cent of their cleaning, maintain cost records, and a fourth road, which uses sand blasting as a general practice, reported that the costs for this work are not known.

While replies to our questionnaire included cost figures covering a wide range, any attempted comparison naturally would involve the consideration of many pertient factors. The general situation in this respect has been aptly summarized by E. R. Needles in a portion of a paper presented before the American Society of Civil Engineers at Kansas City in 1940: "Some engineers are satisfied with steel cleaned for painting by the most slipshod hand methods, and others insist on sand blasting down to bright metal. One method of cleaning may cost 75 cents per ton; the more careful methods may cost several times as much; and the advocate of each method may consider his practice economically sound."

Cleaning Building Surfaces

Since our survey does not reflect the use of any new methods in removing paint from exterior wooden surfaces and inasmuch as detailed descriptions of the several methods in common use were presented in a report on The Inspection and Preparation of Wood Surfaces for Painting, which is included in the proceedings of the Association for 1938, those particular phases will not be elaborated upon at this time. However, replies to our questionnaire reflected in a measure the results of deferred building painting programs during the last decade.

Twelve railways, with a composite line mileage of 89,745, or 43 per cent of the total mileage covered in the survey, reported the necessity of extensive paint removal from the exterior surfaces of wooden buildings prior to repainting. Of these railways, nine representing 57,886 miles of lines or 28 per cent of the total mileage covered, reported that torches were used generally for removing paint, while the three remaining roads were using hand scrapers and brushes for that purpose. Burning outfits which utilize oxy-acetylene or propane gas are being used quite extensively and with good results. A considerable variation prevails in the proportionate cost of the removal to the total painting cost, but in the main, these proportions were lower for burning than for hand removal.

The number of painted brick buildings in general railway use is comparatively small and only two railways reported painting requirements of an extensive nature for such strutures. The general practice, insofar as the preparation of brick surfaces is concerned, involves no large problem and the use of wire brushes and scrapers usually suffices, while in some instances sand blasting is employed.

Apparently there is no general need for the extensive removal of interior paint coatings prior to redecorating, for only one road reported the necessity for such procedure.

A recent application of the flame-cleaning process was used successfully by an eastern road for the removal of a heavy accumulation of badly deteriorated paint from the concrete lining of a passenger terminal tunnel. About 15 coats of both waterproof and casein paint, of approximately ⅛-in. total thickness, were removed from an area of 5,400 sq. ft. in a rapid and economical manner, without causing any damage whatever to the surface of the underlying concrete. In this instance, flame-cleaning was resorted to after several of the ordinary methods of paint removal proved unsatisfactory.

Committee—C. Miles Burpee, chairman, man. ed., Ry. Engr. & Maint. Cyclopedia, Chicago; T. M. Von Sprecken, vice-chairman, engr. br., Southern, Cincinnati, Ohio; R. C. Baker, supv. of scales, C. & E. I., Danville, Ill.; A. E. Bechtelheimer, asst. engr. of br., C. & N. W., Chicago; G. W. Benson, supv. b. & b., C. of Ga., Macon, Ga.; H. M. Buell, br. insp., U. P., Omaha, Neb.; F. G. Campbell, asst. ch. engr., E. J. & E., Joliet, Ill; J. E. Heck, br. insp., C. & O., Peru, Ind.; W. A. Huckstep, bldg. draftsman, M. P., St. Louis, Mo.; T. E. Jackson, supv. b. & b., S. P., Tucson, Ariz.; S. E. Kvenberg, asst. engr., C. M. St. P. & P., Chicago; L. E. Laurent, asst. engr., Erie, Cleveland, Ohio; E. C. Neville, b. & b. master, (retired), C. N., Toronto, Ont.; A. M. Partch, supv. b. & b., N.P., Pasco, Wash.; R. A. Whiteford, div. engr., C. M. St. P. & P., Ottumwa, Iowa; J. J. Wishart, b. & b. supv., N. Y. N. H. & H., New Haven, Conn.; J. F. Zanolio, mast. carp., D. & R. G. W., Alamosa, Colo.

Discussion

A comparative discussion of mechanical and flame-cleaning methods of cleaning steel structures followed the presentation of this report. F. B. Robins (C. & O.) described the manner in which they removed paint from steel structures with pneumatic tools, using a 16-man force equipped with a 60-cu. ft. compressor, 8 pneumatic scrapers and 4 chipping hammers. He added that the chipping hammers were sometimes equipped with long handles to reach inaccessible places. A. M. Knowles (Erie) stated that his road used pneumatic tools for cleaning and found this method very satisfactory. He added that those portions of steel structures exposed to brine drip were given a petroleum base protective coating.

Good results are obtained by using oxy-acetylene torches for cleaning the

paint from steel structures, according to A. L. McCloy (Pere Marquette) but he warned that the men should be properly protected, particularly in the summer time, from the flying rust which was hot and would cause burns if it fell on the hands or arms of the torch operators. The principal advantage of the oxy-acetylene method, he thought, was the ability to reach otherwise inaccessible places and do a good job of cleaning.

K. L. Miner (N.Y.C.) said that they used oxy-acetylene torches for cleaning steel in inaccessible places, such as angles or corners, and added that one of the principal advantages of this method is the dehydrating effect, leaving the cleaned surface dry and ready for the application of paint, an advantage that other methods of cleaning do not provide.

Armstrong Chinn (Alton) mentioned the fact that flame cleaning is now new, but that it has been used for 35 years or more around shipyards for cleaning the hulls of boats. Its principal advantage, in addition to its cleaning action, he said, is the fact that it dries the surface.

J. L. Varker (D. & H.) mentioned the fact that the D. & H. had not used oxy-acetylene cleaning until this summer when the method was tried on three spans of the Susquehanna River bridge at Wilkes-Barre, Pa. The oxy-acetylene cleaning was followed within two hours by pneumatic wire brushing and a spray coat of red lead, after which the final coat of black paint was applied within a day or two. Mr. Varker said that the oxy-acetylene method was very effective in inaccessible places but that he thought it was probably a little more expensive on flat surfaces than mechanical methods of cleaning.

R. E. Caudle (Mo. Pac.) said that his road had used a rust-removing compound on its bridges for the last 8 or 9 years and had dispensed with regular bridge painting gangs entirely. The rust-removing compound, he said, is applied by three men selected from the regular bridge and building gangs.

L. C. Winkelhaus (C. & N. W.) raised a question concerning the best method of removing paint from brick surfaces, saying that his experience with sand blasting showed that it also removed some of the brick surface.

L. E. Peyser (So. Pac.) said that his road had recently remodeled a brick station on which a portion of the paint underneath the exterior coats was thick and gummy and could not be removed by sand blasting. A paving burner was used here to dry out and make the paint brittle, after which it was sand blasted successfully. The surface was then stuccoed.

Chairman Burpee said that experience had taught him that the failure of a new film of paint was frequently caused by applying it over an old paint film that had lost its elasticity. C. R. Knowles (I. C.) added that the time of year is important in painting bridges as well as water tanks. In the case of the latter, he said, the outside or air temperature must be lower than the temperature of the tank itself.

The discussion then turned to the best method of removing coatings of grease and Chairman Burpee said the committee had considered this problem but that the solutions suggested varied considerably. F. B. Robins (C. & O.) said his experience showed that a naptha solvent is more effective than flame cleaning for removing grease coatings.

Bridge and Building Supply Men's Exhibit

C. C. Rausch
President

THIRTY-FIVE manufacturers of equipment, materials and appliances used in the construction of railway bridges, buildings, water service and allied facilities, presented an exhibit of their products under the auspices of the Bridge and Building Supply Men's Association, in connection with the forty-eight annual convention of the American Railway Bridge and Building Association at the Hotel Stevens, Chicago, on October 15, 16, and 17. In recognition of and responding to the increased activity which is ramifying into every phase of railway construction and maintenance, this exhibit was the largest, the most comprehensive, as well as the most colorful, of any presented at a bridge and building convention in more than a decade.

The officers of the supply association who planned and were responsible for the exhibit, which was held in the exhibition hall immediately adjacent to the convention room were: President, C. C. Rausch, Dearborn Chemical Company, Chicago; vice-president, W. S. Carlisle, National Lead Company, Chicago; secretary, R. Y. Barham, Armco Railway Sales Company, Chicago; treasurer, F. A. McGonigle, Mall Tool Company, Chicago; and the following members of the executive committee—honorary director, Harry A. Wolfe, The Lehon Company, Chicago; C. E. Ward, U. S. Wind Engine & Pump Company, Batavia, Ill.; A. J. Filkins, Paul Dickinson, Inc., Chicago; Paul R. Austin, Johns-Manville Sales Corporation, Chicago; Mr. McGonigle; E. C. Bleam, Joseph Dixon, Crucible Company, Chicago; and E. E. Thulin, Joyce-Cridland Company, Chicago.

R. Y. Barham
Secretary

In the election of officers for the ensuing year, Mr. Barham was advanced as president; Mr. McConigle

was made vice-president; W. Lyle McDaniel, Massey Concrete Company, Chicago, was elected treasurer; and Mr. Austin was elected secretary. The new directors were G. B. Coffey, A. M. Byers Company, Chicago; and E. C. Gunther, Duff-Norton Manufacturing Company, Chicago; to succeed Messrs. Ward and Filkins, whose terms had expired.

A list of the exhibiting companies, together with the products on display and the names of their representatives follows:

List of Exhibitors

Air Reduction Sales Company, New York—Electric welding unit and electrodes; oxy-acetylene welding and cutting apparatus; flame cleaning tip—C. B. Armstrong, C. Daly and E. F. Turner.

American Lumber & Treating Company, Chicago—Samples of Wolmanized timber and illustrations of its use—Robert R. Clegg, Henry Garnjobst and R. B. Putman.

Armco Railroad Sales Company, Middletown, Ohio—Samples of Armco's pipe and illustrations of applications; metal building sections; crib walls; air pipe; insulated pipe units—R. Y. Barham, E. T. Cross, R. B. Faries and J. D. Taylor.

Buda Company, Harvey, Ill.—Track and bridge jacks; motor car; track and car jacks—R. M. Blackburn, H. H. Cohenour, W. Ebbert, R. B. Fisher, R. K. Mangan, D. Richards, S. W. Sanford and R. P. Williamson.

Byers Company, A. M., Pittsburgh, Pa.—Radiant heating; samples of wrought iron; samples of pipe, angles, pipe angles and bars—Richard Angel, G. R. Coffey, William Damberg, Kenneth Knapp and D. M. Stembel.

Celotex Corporation, Chicago—Samples of insulation; wallboard; cold storage insulation; interior finish; roofing; gypsum wallboard—J. H. Bracken, W. G. Rogers and H. A. Winandy.

Chicago Pneumatic Tool Co., New York—Portable air compressor; pneumatic steel and wood drills; pneumatic rock and concrete drills; pneumatic paving breakers; pneumatic clay diggers; pneumatic back-fill tampers; pneumatic sump pump; pneumatic wrenches; pneumatic grinders; electric grinders and drills—S. A. Congdon, H. R. Deubel, T. P. Harris, W. J. Pallowick, E. S. Rossell and E. S. Stevens.

Dearborn Chemical Company, Chicago—No-Ox-Id rust preventives; sealing compound for wood water tanks; aluminum protective coating; pipe coating, wrappers for protection of underground pipe; chemical pumps; proportioner—Don Bishop, E. A. Goodnow, Walter Hinsch, C. I. Loudenback, A. C. Moeller and C. C. Rausch.

Paul Dickinson, Inc., Chicago—Roof ventilators; smoke jacks; stove jacks; roof drains; exhaust heads; floor scupper; deck drains; blast plates—A. J. Filkins, E. M. Filkins and H. Knutson.

Joseph Dixon Crucible Company, Jersey City, N.J.—Industrial paints; graphite greases; pipe joint compound; samples of graphite; literature on paints and graphite products—E. C. Bleam and W. Skea.

Duff-Norton Manufacturing Company, Pittsburgh, Pa.—Bridge jacks—E. C. Gunther and J. F. Van Nort.

Independent Pneumatic Tool Company, Chicago—Electric and pneumatic portable tools—A. Anderson, J. Caswell, G. H. Du Sell, R. G. Faverty, N. C. Hurley, Jr., N. C. Kirchner, W. A. Nugent, L. Orland, A. Russell, T. Seward and F. Schiel.

Johns-Manville Sales Corporation, New York—Samples of transite pipe; corrugated transite roofing and siding; asbestos roofing and siding shingles; transite conduit; asphalt tile flooring; asphalt shingles; built-up roofing; prepared roofing; pipe insulation; asbestos wainscoting and wallboard; mechanical packing; asphalt plank—P. R. Austin, R. J. Offutt, T. O'Leary, Jr., W. G. Morehead, H. R. Poulson, W. W. Prosser, F. C. Vandervort and L. T. Youhn.

Joyce-Cridland Co., Dayton, Ohio—Bridge and track jacks; car and locomotive jacks; building jacks—Huston Brown, C. N. Thulin and E. E. Thulin.

Koppers Company, Wood Preserving Division, Pittsburgh, Pa.—Photographs of pressure-treated forest products, bridges, culverts, trestles, water tanks, coaling plants and station platforms—H. C. Busch, M. F. Cravey, John Grennan, A. R. Nickel and G. C. Rosenquist.

The Lehon Company, Chicago—Asphalt shingles; prepared and built-up roofing; cold process built-up roofing; roofing and flashing compounds; literature on roofing; waterproofing materials—John Eipper, Tom Lehon, T. L. Kennedy, E. A. Leonard, John W. Shoop and Harry Wolfe.

Mall Tool Company, Chicago—Gas and electric-driven machines for vibrating concrete and surfacing concrete, with attachments for grinding, pumping water, drilling, boring, driving lag screws, wire scratch brushing and sanding; pneumatic chain saws and cross-cut saws; electric saws; drills; grinders; and chain saws—Robert Burgwald, Stanley Gromnicki, A. W. Mall, F. A. McGonigle and N. Rehnquist.

Massey Concrete Products Corporation, Chicago—Literature on concrete pipe, piling, concrete cribbing and crossing slabs—Ross Clarke, David A. Hultgren and W. L. McDaniel.

Master Builders Company, Cleveland, Ohio—Samples of floor wearing surfaces; rust joint iron; non-shrink aggregate for concrete bonds; reground portland cement paint for concrete surfaces; liquid quick-setting compound; puzzolanic cement dispersing agent for mass concrete; membraneous curing compound; masterplate—D. H. Lee, C. A. Lyon and B. R. Wood.

National Lead Company, New York—Red lead; white lead; white lead paint; red lead paint; literature on red lead paints and the use of white lead—Ralph Baker and Hugh M. Millen.

Overhead Door Corporation, Hartford, Ind.—Overhead door—R. M. Beal, J. Hale, W. Swanson, A. C. Thomas, W. E. Walbert and H. W. Wormser.

Oxweld Railroad Service Company, Chicago—Flame cleaning apparatus; soldering and brazing outfit; complete cutting outfit; photographs of pipe welding, flame cleaning and dehydrating, pressure butt welding of rails, and flame hardening of rail ends; flood lights; samples of welded pipe and wrinkle-bent pipe—Lem Adams, C. J. Gavin, E. B. Hall Jr., Henry Hoffman, S. B. Hopkins, P. Hunter Jr. and G. B. Moynahan.

Patterson-Sargent Company, Cleveland, Ohio—Bridge, building and car paints; and literature on bridge paint—Geo. W. Anderson, Ben Bowman and W. H. McBride.

Railway Engineering and Maintenance, Chicago—Copies of publication—G. E. Boyd, F. R. Brewster, C. M. Burpee, S. W. Hickey, N. D. Howard, E. T. Howson, C. W. Merriken, H. A. Morrison and J. S. Vreeland.

Railway Purchases and Stores, Chicago.

Ruberoid Company, New York and Chicago—Asbestos roofing and siding shingles; asphalt shingles and prepared roofing; models of built-up roofing—Geo. R. McVay.

Sherwin-Williams Co., Chicago—Display cans of paint; exposure panels; display panels; literature on finishes—R. D. Baker, G. A. Dorwart, H. M. Faber, W. J. Montgomery, E. M. O'Brien and C. A. Proseus.

T. W. Snow Construction Co., Chicago—Enginehouse door hanger—J. E. DuPree and B. S. Snow.

The Stanley Works, Stanley Electric Tool Division, New Britain, Conn.—Portable electric power saws; portable electric power drills; portable electric power hammers; portable electric sanders; portable electric power unishears; portable electric power nut and lag screw setter—E. C. Koenig, A. J. Peterson, P. C. Platt and L. R. Warnock.

Timber Engineering Company, Washington, D.C.—Timber connectors; termite shields; and literature on connectors and timber design—J. B. Jordan and L. P. Keith.

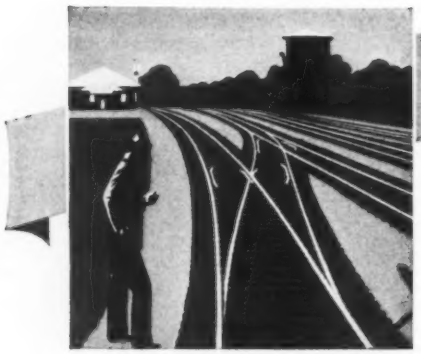
U. S. Wind Engine & Pump Company, Batavia, Ill.—Pump jack; tank stuffing box; float valves—H. W. Beem and A. Swanson.

Wailes Dove-Hermiston Corp., Westfield, N.J.—Displays of bitumastic enamel on pipes and floor surfaces; chromastic aluminum; chromastic metal primer; bitumastic black solution; bitumastic super-service; florex floor enamel; bituglass industrial enamel; bitumastic exterior-interior paint; literature on all foregoing—photographs of coal bunkers; railway bridges; cranes; water tanks painted with bitumastic—J. J. Clancy and C. V. Lambe.

Warren Tool Corporation, Warren, Ohio—Flex-toe claw bar—W. H. Bon and Oscar Youngquist.

Wheeler Lumber, Bridge & Supply Co., Des Moines, Iowa—Laminex railway crossing; lag bolt fastening; laminex literature—C. M. Mitchell.

Worthington Pump & Machinery Corp., Harrison, N.J.—Pneumatic concrete breaker; pneumatic rock drill—Paul Blakeley and Harry W. Miller.



WHAT'S the Answer?

Uses for Second-Hand Ties

What disposition should be made of ties that are found to be sound after they are removed from the track?

Does Not Know the Answer

By G. L. Sitton

Chief Engineer Maintenance of Way and Structures, Southern, Charlotte, N. C.

This is a problem to which we have given much study, but I am frank to say that I still do not know the answer. In the first place, a foreman should find out whether a tie is sound before he removes it from the track, and if it is sound it should not be removed. The exception to this general rule is creosoted softwood ties on a curve, which are too soft to hold the gage satisfactorily. Obviously, such ties should not have been inserted in the curve, but on our road we have many creosoted pine ties that were applied in curves when that was the only place we had tie plates and we did not want to use the treated ties without tie plates. We have since removed many of these ties and reapplied them on tangents, or in sidings.

Whether the service we have obtained from these ties has warranted the expenditure for labor to remove and reapply them is an open question, and this is the primary reason why I say that I do not yet know the answer to the question. We have some foremen, some supervisors and some roadmasters who believe that they have saved money for the company by reapplying the ties in the manner described. I have seen a few cases where such poor judgment was used in removing a tie that there was no doubt that it was economical to re-install it.

On the other hand, doubtless we have re-installed some ties from which we did not obtain enough additional service life to warrant the cost of doing so. In some cases this may have been, in part, because the ties were not reused promptly after removal. I consider it important that any ties that are to be reapplied be inserted in the track as soon as possible after they have been removed.

Must Know Why Removed

By F. G. Campbell

Assistant Chief Engineer, Elgin, Joliet & Eastern, Joliet, Ill.

One must know why the tie was removed before he can answer this question. If a foreman, through carelessness or error, removes a tie that is still serviceable in its original position, he should be required to reinsert it either at its original location or as near there as practicable. This usually causes him to be more careful in removing ties that still have an appreciable service life. On the other hand, it often occurs that ties that are otherwise sound must be removed, especially on sharp curves, because of spike cutting or other forms of damage. In such cases these ties should be saved and used in industrial or yard tracks.

Where giving main tracks a general surface, ties are often removed that still have several years of service life remaining, and these are generally suitable for insertion in tracks of light traffic. Care should be exercised, however, in the use of second-hand ties, since it costs approximately $0.50 to handle and insert a second-hand tie which will have less than five years service life remaining after it has been reapplied.

Those roads that have been using creosoted ties for only a relatively

Send your answers to any of the questions to the What's the Answer Editor. He will welcome also any questions you wish to have discussed.

To Be Answered in January

1. Where supply cars are not operated, is it practicable to require foremen to turn in old tools in exchange for new ones? If so, how is the exchange made? If not, why? What disposition should be made of the old tools?

2. Is it practical to estimate the cost of new buildings on the cubical contents basis? If so, how should this method be applied for various types of buildings? If not, why? What other satisfactory methods can be employed?

3. Are rails longer than 39 ft. desirable? Why? Are there limitations? If so, what?

4. What are the relative advantages and disadvantages of lag screws and bolts for fastening outside guard rails on open-deck trestles? What diameter of hole should be used? Why?

5. What causes kinking at the heel of the switch? How can it be overcome?

6. What is the best method of cleaning pipe lines of hard scale? Of soft sludge? What precautions must be taken?

7. Should ties be distributed by train at the point of use or should they be set out in cars at stations and later distributed by motor car and trailer? Why? What are the advantages? Does the time of receipt make any difference?

8. What precautions should be observed when applying tinted paints to interior wall surfaces? Why?

few years will find that, in general, the removal of such ties is caused almost entirely by breaks or splitting, brought about for the most part by derailments or other accidents. Such ties may be unfit for further use as crossties, but do have definite value for uses as posts or cribbing. Until a stock is created that is too large to be carried conveniently, all such ties should be saved for some future use other than as crossties.

Do Not Remove Them

By M. J. Hanna

General Foreman, Track and Labor Department, Jones & Laughlin, Steel Corporation, Pittsburgh, Pa.

A foreman who is qualified to handle a section should have sufficient knowledge of timber to know when a tie is or is not sound, and a sound tie should not be removed from the track. However, a tie that is not decayed may be damaged by over spiking, plate cutting, etc., to such an extent that it is unfit for main-track use, yet it will last for several years in other service. Such ties can be used in secondary tracks or sidings, as fence posts or as cribbing. In some cases, several years additional life can be obtained by turning the tie over and using it again in its original location or in a less important track.

Handling Is Expensive

By W. H. King

Section Foreman, Missouri Pacific Lines, Francitas, Tex.

Even with the most careful attention, sound ties will sometimes be removed through error. Where this occurs they should be inserted again as near the point of removal as is practicable to save the cost of handling. Handling costs alone may be greater than the remaining value of the tie and the matter of re-use should be considered thoroughly in the light of this fact. However, I have found that it often pays to remove a joint tie, replacing it with a new one, and re-use the old tie in or back of the quarters.

Use in Sidings

By Julius M. Bischoff

Office Engineer, Terminal Railroad Association, St. Louis, Mo.

Sound ties removed from main track should be used to replace unsound ones in secondary tracks. If an appreciable period elapses before they can be re-used, they should be stacked in closely piled stacks to prevent, so far as practicable, exposure to air and moisture. These stacks should be protected on all sides, and on tops and bottoms, with corrugated iron, tar paper or other similar material Exposure to the elements causes rapid deterioration to wood that has been imbedded in earth, cinders, gravel or other forms of ballast. If sound ties are removed from yard or other secondary tracks, they should be replaced in their original location and not used for replacements.

Pipe for Suction Lines

What are the relative advantages of wrought-iron or steel pipe with screwed couplings, bell-and-spigot pipe and flanged cast-iron pipe for suction lines? Why?

Screwed Joints Up to 8 In.

By J. P. Hanley

Inspector of Water Service, Illinois Central, Chicago

Wrought-iron pipe with screwed joints, in sizes up to and including 8 in., is good construction. To guard against soil corrosion, extra-heavy instead of standard-weight pipe should be used, and the outside of the pipe should be treated with a rust preventive. These sizes are small enough to permit coupling in the trench without undue cost. The screwed joint withstands vibration from traffic, pump operation and water hammer, better than caulked joints, and has long been a favorite for preventing leaks in suction lines.

Steel pipe with screwed joints acts similarly to wrought iron in these respects, but it does not withstand soil and other corrosion as well as the wrought iron. Both steel and wrought-iron pipe are more flexible than cast iron and do not break or snap under tracks or at points where unequal settlement occurs, as sometimes happens with the more rigid cast iron. On the other hand, cast iron is more resistant to soil corrosion, but this advantage may be sacrificed for the increased operating benefits obtained from the wrought pipe and screwed couplings during their useful life. After all, suction lines are usually short and the investment cost is relatively small and should not be given undue prominence.

If the suction line is more than 8 in. in diameter and of considerable length, flanged or caulked joints may be considered. The weak part of the flanged joint is the bolts, but this may be overcome by using extra heavy flanges with an increased number and diameter of bolts. Where bell-and-spigot pipe is used, care should be exercised to get good joints, with plenty of caulking material. Cast-iron pipe should be cushioned on sand in the bottom of the trench, where rock or other formation might cause unequal settlement. Clamps should be used to reinforce the caulking material where vibration from traffic or other sources is expected. A suction line should be laid on a true and uniform gradient to avoid air pockets, and the joints should be butted together to reduce resistance to flow.

Must Be Air-Tight

By E. M. Grime

Engineer of Water Service, Northern Pacific, St. Paul, Minn.

That pipe which will most certainly remain air tight will be the best. A leak in the suction line which allows air to enter and flow along with the water affects directly the efficiency of the pump. If the pump is of the centrifugal type, sufficient air may soon collect in the pump to cut off the water flow completely, unless it is released automatically or in some other way. If the pump is of the positive-acting type, the drawing of air through the line will also affect its efficiency.

For these reasons, it is essential that the suction line be air-tight, and iron or steel screwed pipe is most likely to fill this requirement. Unfortunately, steel pipe is quite susceptible to soil corrosion, so that cast-iron bell-and-spigot pipe is used frequently for suction lines. If it is laid carefully and tested thoroughly before being placed in service, it may prove to be satisfactory over a long period. It is to be preferred to flanged cast-iron pipe because the joints are more flexible, thus allowing for unequal settlement of the pipe without danger of breaking the flange connections and starting leakage.

Where a suction line extends out into a stream which has a large variation of flow, and where trouble is experienced with ice or floating debris, at certain seasons of the year it may be necessary to shorten or lengthen

the line. Under such conditions, flanged steel pipe will be indispensable by reason of the ability to connect or disconnect the pipe during unusual situations created by floods.

Screwed Joint Is Simplest

By K. J. Weir
Special Water Inspector, Chicago, Milwaukee, St. Paul & Pacific

To some extent, physical conditions may require the use of a certain type of pipe, in which case the designer may be limited in selecting the type of joint he prefers to use. The screwed coupling is the simplest and cheapest type of joint for suction lines, and is the one most commonly used in ordinary pipe work. It is rigid and strong, small and compact, and can be assembled by unskilled labor. It requires less digging for underground assembly, and if used with pipe covering, the joints can be covered readily.

Bell-and-spigot joints permit deflections in pipe lines, but they must not be disturbed by flexing or leakage will develop. Oakum and jute used for yarning, if not sterilized, may cause contamination of the pipe if it is part of a drinking water system. Preparation of suitable bell-and-spigot joints for suction lines requires carefully trained, experienced labor, and selection of the proper jointing material, and involves some risk in heating, handling and pouring the molten metal. The joints must be made in place and left undisturbed, with maximum care exercised in backfilling. Random lengths of pipe can be used with bell-and-spigot joints.

Flanged joints on cast-iron pipe give excellent service when used in suction lines. They should be assembled by experienced men in such a manner that gaskets will not encroach on the opening in the pipe and all bolts must be tightened evenly to avoid pinching the gaskets, since pinched ring-type gaskets tend to leak. Flanged joints are the easiest to dismantle when it becomes necessary to remove the pipe. Flanged and threaded pipe come in definite lengths which cannot be altered, except by cutting new threads or splicing with other types of joints.

When Planning Rail Renewals

What considerations should be given weight when deciding on rail renewal? What is the importance of each?

Many Factors

By Bernard Blum
Chief Engineer, Northern Pacific, St. Paul, Minn.

Among the considerations to be given weight when deciding on rail renewal are: (1) the condition of the old rail, as determined by head wear, joint batter, wear on the fishing surfaces, etc.; (2) the condition of the fastenings, particularly with respect to wear on the angle bars; (3) the size of the present tie plates and their adequacy, as measured by the amount the ties are cut; (4) the condition of the existing ballast; (5) the failure record of the rail under consideration; and (6) the adequacy of the existing rail section.

In isolated cases, the last item may be the determining one, because large and sudden increases in speeds, axle loads, etc., may necessitate the replacement of light rail before the rail itself is worn out. If the section is adequate to sustain the loads and permit the desired speeds, then the physical condition of the rail under consideration must be examined.

On lines of very heavy traffic, the rail may be worn to the limit of safety; on lines of lighter traffic, joint batter, causing poor riding and high maintenance, is important. It may be possible to correct this by welding, however, which generally calls for new joint bars. Relatively small tie plates are generally used with the lighter sections of rail, so that note should be made of tie cutting. The failure record of the rail should also be examined, for a large number of breaks of certain types, such as those inside the joint bars and through the bolt holes, suggest that the end of the service life of the rail is approaching.

The condition of the ballast should also be considered. If this is such that immediate reballasting is necessary it is sometimes economical to renew the rail at the same time, instead of carrying it over for one or two years, with the consequent additional expense of spacing the ties, surfacing and other similar work that must then be repeated.

If the rail section, in itself, is adequate and safe, then possibly no one of these items alone will be sufficient to justify the heavy interest charges resulting from the rail renewal. On the other hand, the total saving in maintenance costs by the elimination or reduction of surfacing, welding, tie cutting, etc., may well do so.

Frequency of Failures

By C. W. Baldridge
Assistant Engineer, Atchison, Topeka & Santa Fe, Chicago

Conditions that affect the smooth riding of trains and the safety of their operation are the factors that enter basically into the necessity for renewing rail. So far as the rails are concerned, the safety of train operation depends on their soundness and their straightness. Smooth riding depends on the smoothness of the running surface of the rails, as this is affected by battered ends, driver-burned spots, and by bad line and surface resulting from bent and kinked rails. Smooth riding will also depend on the standard of track maintenance with respect to line and surface, as they are affected by ballast and roadbed maintenance, but battered ends, kinks and bends and burned spots in the rails eventually make it impossible to keep them in good line and surface.

In checking the condition of the rails with respect to the safety of train operation, the following factors should be investigated:

1. The amount of traffic that has passed over the rail. This should be reckoned in gross tons per mile. This determination should be made because rails develop a greater tendency to fail as the amount of traffic passing over them grows larger.

2. The number of rail failures during the last five or six years, as well as the kinds of failures, is important; numerous transverse and compound fractures indicate that much further use of the rail under heavy and high-speed traffic will be unsafe.

3. The frequency of wear spots, that is, the black wear spots along the gage edge of the face of the rail, as distinguished from driver-burned spots, should be investigated. This type of wear spot frequently gives forewarning of compound fractures or horizontal split heads, with consequent breaking of the rail.

4. Measurement of the batter of the rail ends made over a given distance, at occasional joints in the stretch of rail under consideration, will show the average condition with respect to batter.

5. The condition of the joint bars with respect to wear on both their bearing faces and the outside surfaces. If brine drippings are troublesome, this should be noted.

6. The condition of the rail base, the tie plates and the spikes should be given consideration, especially where brine drippings from refrigerator cars occur.

7. The frequency and extent of kinks and bends in the rails. This is a factor that requires careful consideration, for many rails show much greater variation from straightness after they have been removed from the track than was evident or even suspected prior to their release.

In most cases all of the foregoing items and factors enter into the necessity for or desirability of renewing rail. On the other hand, in some cases, only a single factor, particularly the frequency of failure, may make the renewal of the rail imperative. The most important factor that should be considered is that of rail failures, for it has the greatest bearing on the safety of train operation. The relative importance of the remaining factors will depend on their extent and, in most cases, the renewal of the rail becomes a necessity by reason of a combination of all or a part of these factors and their magnitude.

Cant Hooks and Treated Timber

Can the use of cant hooks and dogs be eliminated in handling heavy creosoted timbers? If not, why? If so, what alternate methods and tools should be employed?

Not Feasible

By G. A. Haggander
Assistant Chief Engineer, Chicago, Burlington & Quincy, Chicago

At our treating plants, where we handle a large volume of timber and lumber, use is made of cable slings for handling several pieces at one time, where it is practicable to do so. However, while we have experimented with devices for handling single sticks, nothing has yet been developed than can replace timber hooks, as none of these devices afford a positive grip.

When handling lumber by hand in the field, we still use cant and lug hooks, but the injury to timber by these two tools is not so serious as by timber hooks that are operated by power machines. We all realize that any break in the surface of creosoted timber is undesirable and we will welcome a method of handling it safely, that will eliminate this feature.

Yes, With Reservations

By C. S. Burt
Manager Forest Products Bureau, Illinois Central, Memphis, Tenn.

It is my observation that the use of cant hooks and dogs can be eliminated, but certain reservations to this statement must be made. Some wood-treating companies and other industries are handling heavy creosoted timbers without the use of cant hooks, these methods having been followed for some time, although the volume of material so handled is not great. It should be noted, too, that the timber is handled more slowly, compared with other methods, and that the cost is correspondingly higher. It has also been my observation that considerable damage can and does occur when the timbers are handled with chains or with cable slings, because they are pulled out forcibly from beneath the load after it has been landed. This may be a deep cut into the wood or a sizeable piece torn from the corner of a stick, in some cases resulting in exposure of the untreated wood, or in making the material unsuited for the purpose for which it was intended.

While the use of cant hooks and dogs appears to be the general practice at treating plants, I am sure that the plant operators appreciate that serious damage can be done to treated wood through carelessness, and that measures are in effect to avoid it. It can be said that the use of hooks and dogs permits the speeding up of the handling operation and results in somewhat lower handling costs. Where care has been used I have never observed any serious damage to treated timber.

I have mentioned the methods in vogue at the treating plants because the same line of reasoning applies to the use of cant hooks and dogs when handling the same material at the site of the work. In fact, it seems doubtful whether any other tool or equipment yet devised can be substituted satisfactorily for the cant hook.

From long contact with the treatment and use of timbers, I believe that it is possible, as already indicated, to eliminate the use of hooks and dogs in most cases; yet I also believe that as used, these tools are generally quite satisfactory and that very little damage is done to treated timber by reason of their use.

While the following has no direct connection with the question, it seems fitting to call attention here to the possibility of serious damage to creosoted timbers while they are being unloaded at the site of the work. Sometimes equipment suitable for handling the timbers is not available or is not made use of for some reason, and wire, bands or other load fastenings are merely cut and the load is permitted to roll or fall off the cars. This may create far more damage than is likely to be done to timber that is handled with cant hooks and dogs.

What Speed Restriction?

Should section men allow for trains exceeding speed restrictions when placing slow orders, or should they specify the maximum speed thought safe and report any failure on the part of trainmen to observe the restrictions set?

Make no Allowance

By A. B. Chaney
District Engineer, Missouri Pacific, Little Rock, Ark.

Foremen and others who place slow orders should not make any allowance for trains exceeding speed restrictions when placing slow orders. They should give trains the full benefit of the maximum safe speed and report any violations that occur. The maximum safe speeds to be observed under given conditions are seldom susceptible of exact determination, however, but are based on the judgment of an experienced foreman. For this reason, his judgment will be conservative and will include a factor of safety, almost without exception. To reduce the allowable speed further will impose unwarranted delays to traffic.

If the maintenance forces make a practice of specifying in slow orders speeds, say five miles an hour, less than the maximum safe speed, it will become an open invitation to trains to operate at speeds higher than authorized, thereby nullifying the original

intent of the order. On the other hand, compliance with speed restrictions can be expected if train crews understand that slow orders authorize the maximum safe speed without allowances. Proper train operation requires that we assume that train orders will be obeyed and that follow-up checks will be made to assure that they are being obeyed.

Involves Human Element

By R. A. Hostetter

Welder, Texas & New Orleans, Ennis, Tex.

Slow orders should specify the maximum safe speed. The placing of a speed restriction involves the human element, and it is true that some train and enginemen are over-anxious to make their schedules, and that others are inclined to take chances. We must bear in mind, however, that the majority of both train and enginemen live up to the rules laid down for their guidance. For this reason, if the speed restriction is lower than the maximum safe speed for the passage of trains, there will be unnecessary delay to the majority of the traffic passing over the restricted track and in many cases to all traffic.

When setting up the maximum allowable speed for trains, the foreman should take into account all irregularities affecting the track or structure, as well as the underlying conditions, and should then select the speed limit which, according to his best judgment, is consistent with safety. If he should have any doubt he should consult his superior officer by telephone or telegraph, explaining in detail all of the circumstances surrounding the situation.

There is no point in making allowances for failure on the part of trainmen to observe orders. The maximum speed for the safe operation of trains should be specified. Then, if trainmen fail to observe the restrictions so specified, by all means, their failure to do so should be reported. It will take only a few applications of discipline to eliminate the ignoring or violation of slow orders.

Specify Maximum Speed

By W. Woolsey

Section Foreman, Illinois Central, Chicago

No slow order should ever be placed unless it is necessary to insure the safety of trains or of men engaged in maintenance, who cannot be protected in any other manner. The demands for accelerated movement of both freight and passengers are so insistent that trains should not be delayed, except where safety is involved. For this reason, when it becomes necessary to apply a speed restriction, this restriction should never be below the limit of safety, and there should be complete insistence on its observance.

Obviously, what the safe speed is over a section of track or a structure is a matter of judgment which cannot be reduced to a formula. It is a matter of judgment for the foreman, however, and not for the train or enginemen. Having specified what he considers the maximum of speed, he should check carefully to insure that trains are observing the slow order, and should report any violations at once.

Making allowance for trains exceeding the specified speed is merely to invite that this be done, and the foreman has no defense if some accident results. If, on the other hand, he specifies what he considers the maximum safe speed and insists on its observance the train crews must accept the responsibility for violations; his skirts are clear and the crew is on the defensive. Train crews will obey orders if the division officers insist that this be done; otherwise it is a confession that they have little control over these crews.

A slow order is a necessary evil; it should be applied only in cases of necessity; it should extend no farther than the conditions require; and it should be lifted at the earliest possible moment. A slow order should no longer to be looked upon as a convenience to the maintenance forces, but as a protection to trains, and it should be handled accordingly.

Metal Plates for Trucking

Do metal plates make satisfactory trucking surfaces for freight-house floors? If not, why? If so, how should they be applied? How thick should they be?

No Substitute for Maple

By General Inspector of Buildings

There is no entirely satisfactory substitute for maple flooring as a trucking surface on long truckways. There are several materials, however, that are superior to maple for general floor construction in freight houses, especially for floors that are subjected to heavy trucking service. Most of the trucking in freight houses is done with hand trucks having steel tires. Smooth steel plates, that is, boiler plate, are suitable for trucking runways, but are not entirely satisfactory because they become slippery, sometimes making it difficult to control the trucks and creating hazard of personal injury.

Checker plates are the only other type of metal plates with which I am familiar that can be used for this purpose. They are less satisfactory than the smooth plates for long truckways, for while they do not become slippery, the corrugations interfere somewhat with the handling of the trucks. They are entirely suitable for general floor construction, however, and are adapted particularly for use in houses where machinery and other heavy freight are handled, for they do not break and are not injured by impacts from falling objects.

Where metal plates are employed, they must be fastened securely, which is not always easy to do when they are being applied to an old floor. One mistake that is sometimes made when placing plates for long truckways, is to lay them on top of the existing floor. This leaves a slight difference in elevation, which may interfere with getting heavily loaded hand trucks onto the truckway. If they are set into the old floor to avoid this difficulty, it is difficult to obtain a flush joint and there is a tendency for the wood to wear immediately adjacent to the plate, eventually creating a slight depression.

In this form of construction it is customary to use old boiler plates for truckways. This material is not always straightened properly when received and considerable work may be necessary to complete the straightening. While I have never used lighter plates, I have been told that 10-gage metal sheets have been quite satisfactory in some instances and that they can be laid on top of the old floor without offering any obstruction to trucks running on and off truckways.

Can Be Used to Advantage

By Supervisor of Bridges and Buildings

For many years maple has been the most popular material for truckways in freight houses. Today, however, the price of maple lumber has advanced to the point where its economy comes into question, provided a sat-

isfactory substitute at a lower cost can be found. While other woods have been used for this purpose, none has been found that is fully satisfactory because of relatively rapid and uneven wear, splintering and warping. I am aware that black gum develops high resistance to wear, that it does not splinter, and that it has been used successfully for floors subject to heavy trucking, but I have never seen it used for longitudinal truckways where the material should be of the usual flooring thickness.

For the reasons mentioned, we have turned to other materials, among them metal plates, to determine whether an economical and satisfactory substitute can be obtained. Steel plates are smooth and highly resistant to wear; they do not warp, provided they are anchored properly, or splinter, and they are not damaged by metal tires. They do become slippery, however, and truckers must use care to avoid slipping or falling. I would not recommend them for general floor construction in freight houses or warehouses.

We have also tried out checker floor plates for both trucking runways and for the general floor area. They have the advantage that they do not become slippery, but because of the surface corrugations they are not as suitable as the smooth plates for long truckways where hand trucks with steel tires are employed. On the other hand, where power trucks with rubber tires are in use, checker plates are as satisfactory as any other material, and the problem resolves itself into a determination of relative costs. While it is a simple matter to compare initial costs, it is not so easy to determine annual costs, since we have no information concerning the ultimate service life of either the smooth or the checker plates.

While I have never used treated black gum for freight-house floors, primarily because we have not built or reconstructed any freight houses since this material came into prominence, I have examined several creosoted black gum floors and I am convinced that from several points of view it can be employed satisfactorily. Care must be exercised, however, to insure that it is laid to a smooth surface and that it is supported so that this surface can be maintained.

Lag Screws vs. Cut Spikes

Are lag screws or cut spikes more effective as independent fastenings for tie plates? Why? Are there other considerations?

Lag Screws Stay Tight

By I. H. Schram
Engineer Maintenance of Way, Erie, Jersey City, N. J.

Maintenance engineers have given much thought to protection of the tie against mechanical damage since treated ties have come into general use. This was not a serious problem with untreated ties since they generally failed from decay, spike killing or other causes before failure could occur from the cause generally called mechanical destruction. The picture changed quickly after treated ties had been in use long enough for maintenance engineers to appreciate the great economy resulting from their use, and to understand that the mechanical strength of the treated wood remained practically constant to the end of the effectiveness of the treatment against decay. This mechanical strength had to be maintained, however, by retaining the full cross section of the ties. Furthermore, the ties had to be protected from checks, splits, the necessity for regaging and similar destructive action. Many measures were taken, each of which solved some phase of the problem.

Longer and wider tie plates to give more bearing were the result of an early thought. The eccentricity of the tie plate, that is, the moving of the rail seat toward the outside of the tie plate, was studied and increased where possible, resulting in a decreased amount of gaging. The design of the bottom of the tie plate has been a subject of discussion as long as there have been tie plates, but the recent tendency is to decrease wear on the tie by reducing the depth of the bottom fins or patterns to decrease the splintering of the grain of the ties. With all of these protections, there was still not sufficient decrease in the sinking of the tie plate into the tie.

Study indicated that this was not caused by lack of bearing area or by bottom patterns, but by the action of the rail creating a rubbing movement between the bottom of the tie plate and the top of the tie. One method to stop this was the cambering of the tie plate, but this did not solve the problem entirely. Additional fastenings, independent of the spikes holding the rail, was the measure then taken to cure the trouble, and we believe that it has been successful. There are two principal forms for these fastenings—one, the lag screw and the other, the cut spike.

Obviously, the lag screw is considerably more expensive than the spike and, to be fully effective, it also requires a double-coil spring washer between it and the tie plate to take up the withdrawal action which affects even a tight screw. This is corrected in track spikes by tapping them down as often as may be necessary. The cost of a lag screw is approximately $0.053 and of the washer $0.026, a total of $0.079 per unit, whereas a cut spike costs about $0.022. The cost of application for the lag screw is about one cent, whereas the cost of applying a cut spike is only a small part of this.

On the other hand, it has been found by experience with many hundreds of miles of track that the lag screws stay tight and that the rubbing action between the tie and the plate is eliminated. In fact, there are many thousands of tie plates applied with lag screws that have been in extremely heavy-traffic track for 10 years, and which have not yet sunk their depth into the ties. This has repaid the cost of the lags many times by increasing the life of the ties. Although cut spikes, when kept tight, help to eliminate noise and add to the gage-holding quality of the tie plates, these functions are performed much better by the lag screws, which are also much more effective in decreasing wear between the tie plate and the tie. In fact, they virtually make the tie plate an integral part of the tie.

Too Many Devices

By George S. Crites
Division Engineer, Baltimore & Ohio, Punxsutawney, Pa.

The fewer kinds of appliances that are used in the track structure, the simpler will be maintenance and replacements. Lag screws for fastening tie plates to ties adds another material and another tool to be carried in the storehouse stock and in the tool house. Tie plates should be flattened at the ends where lag screws are used; this calls for another design of tie plate. Regular track spikes fasten regular tie plates securely to the ties. These spikes do not get the direct thrusts to which the rail holding spikes are subjected and do not work loose so readily. Tapping them down after the plate is seated is usually effective

in keeping the plate against the tie.

Where trouble is experienced from brine drippings or excessive corrosion, the heads of the lag screws are soon eaten so badly that a wrench cannot be used to tighten them. A spike maul will then be used on such screws. It is true that coil-spring washers can be used with the lag screws to keep the plate firmly against the tie, but here again is another appliance to keep in stock and bother with. Lag screws and coil-springs washers have their place where there are no brine drippings or much corrosion from other causes, but not where the track is far from being a permanent structure.

Must Use Best Method

By W. H. Sparks
General Inspector of Track, Chesapeake & Ohio, Russell, Ky.

With the heavy traffic and high speeds of today we must resort only to the best methods available for holding our tie plates and rails to the ties. My observation leads me to believe that the lag screw, when used as an independent fastening for the tie plate, is the best type of fastening for curves, but I am not so sure that this is also true for tangents. If they are not fastened securely to the ties, tie plates will chafe the ties as the wheels pass over them, causing abrasion of the wood fibre. This constant attrition, generally known as plate cutting, causes the tie plate to settle into the tie and eventually weaken it, the rate of cutting being roughly proportional to the amount of traffic. As the plates settle, it becomes necessary to tighten and retighten the independent fastenings to prevent relative movement between the tie plate and the tie.

If the holes for the lag screws are not bored deep enough to permit retightening after the plates are well seated, it will be better to omit the screws. The first reaction of the section laborer, when a screw reaches the bottom of a hole and will go no farther, is to strike it with a spike maul. Obviously, this destroys the wood fibre around the hole, and the screw not only becomes worse than useless, but the way has been opened for rapid decay of and around the damaged fibres. For this reason and to insure drainage, the hole should be bored through the tie.

Many roads are using cut spikes as independent fastenings. They cost considerably less than the lag screws and spring washers, and can be driven more easily and faster than the screws. I believe that they are satisfactory for tangents.

Selecting Interior Paints

What considerations should be given weight when selecting paints for building interiors? What is the importance of each? Does the use to which the building is put make any difference?

Must Withstand Cleaning

By V. E. Engman
Chief Carpenter, Chicago, Milwaukee, St. Paul & Pacific, Savanna, Ill.

In general, the chief purposes of painting building interiors are to promote decoration and cleanliness. Interior paint, unlike paint applied to exterior surfaces, is not subject to the ravages of the elements. For these reasons, in selecting paint for interior surfaces the considerations of first importance, after the color scheme has been decided on, is how long the interval will be until the next painting. For the average station and office building, a paint should be used that will resist several cleanings by either the dry or wet method, without streaking or discoloring. For offices that are painted annually, a less costly paint, such as the cold-water type, should be considered. For shops and storehouses, where light colors are used to improve the lighting, a paint that will successfully stand cleaning should also be selected.

Do Not Overlook Lighting

By General Foreman of Painters

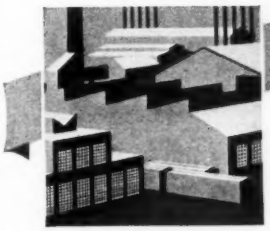
Obviously several considerations enter into the selection of paint for use on interior surfaces. While the color scheme and the decorative effects of this scheme are important, it is an unfortunate fact that in many cases the most important consideration is either ignored or given little thought. In recent years there has been a marked advance in methods and equipment for interior illumination and, to a large but wholly insufficient extent, the railways have profited from the improvements that have been made in both illuminating systems and in the more efficient lighting devices that are now available to them.

In the modernization of passenger stations, some roads have taken advantage of the opportunity thus afforded to install modern lighting that not only gives a splendid decorative effect, but also produces ample illumination with softened light. To do this, however, it is necessary to use light-reflecting rather than light-absorbing surfaces. While these effects are being obtained in some instances through the use of some of the newer and recently developed wall materials, in most cases paint plays an important and sometimes vital part in the scheme. Unfortunately other roads have remodeled stations and other buildings without applying these principles and while, in some instances, the decorative scheme is pleasing, the maximum benefit is lost through poor illumination, which can be traced back to improper reflection from the walls.

It is in offices and other buildings where groups of employees work that the selection of the paint assumes its greatest importance. The human eye requires ample light to enable it to function, and any degree of illumination that falls below the required level will impair both vision and efficiency, for where vision is impaired efficiency drops, and in an office or shop this is translated into a money loss. Badly lighted rooms create eye strain and eventually permanent impairment of vision.

Obviously, the best illumination comes from natural lighting, but it is not enough merely to admit daylight to a room, for daylight so used may be harsh and objectionable. Sharp contrasts between lights and shadows must be eliminated. The ideal illumination comes from a soft all-pervading light in which all shadows are erased and this can be attained only through the use of light colors for the walls and ceiling. Surfaces treated in this manner, will reflect and cross reflect the light in such a way as to eliminate the shadows and make even the corners light, regardless of whether the source of the light is natural or artificial.

In selecting white or tinted paints for interior surfaces, it is desirable to avoid those in which the vehicle is linseed oil, for linseed oil tends to turn yellow and present an unpleasing appearance when applied to interior surfaces. Paints containing lead mixing oil are better. Enamels are not as satisfactory as flat surfaces for the reflections which they provide are likely to be too brilliant and too harsh.



PRODUCTS of Manufacturers

Laminex Culverts

The Wheeler Lumber Bridge & Supply Company, Des Moines, Iowa, has developed two new types of culverts with either rectangular or round openings, known as Laminex culverts. The Laminex culverts are made of laminated sections of creosoted wood which interlock and fit together to form a solid, unified construction.

The rectangular Laminex culverts are assembled from sections made of laminated strips which are separately treated before being assembled into the flat sections with special galvanized nails. The sections are approximately four ft. in length, except for the end sections, which provide for sloping head walls. A special interlocking corner design provides a bearing for each laminate strip of the top and bottom sections on a laminate strip in the side sections. The sections are assembled so that the strips of the side walls and the top and bottom interlock and the sections of the top and bottom also overlap to the center of the side sections.

The rectangular culverts are provided with sloping head walls to fit the slope of the embankment, with parapets and with underground curtain walls at the ends. They are ready-made in single, double, triple and quadruple types with openings varying from 15 in. by 15 in. to 72 in. by 72 in. and larger. The wall thickness of the top and bottom sections varies from 3 in. up to 6 in. and the wall thickness of the side sections varies from 2 in. up to 5 in., depending upon the size of the opening.

The round Laminex culverts are assembled from treated laminate strips which are framed with a modified form of tongue and groove joint, permitting interlocking construction and a circular assembly without breakage of flanges. The strips overlap lengthwise to the middle of the adjacent strips, eliminating open joints. Metal bands are added as the round Laminex culverts are assembled and tightening of the bands bind the culverts into a single pipe unit.

Numerous advantages are claimed for both types of Laminex culverts. The treatment of the strips before assembly provides thoroughly impregnated wood which has a long life, is not affected by decay, continuous freezing and thawing, by acids or alkali. There are no open joints to pull apart in either type of culvert, and they may be extended to any desired length by simply adding strips or sections as the case may be. In addition, they may be removed and reassembled in other locations without waste or cutting. The culverts are said to be sufficiently strong for any purpose, and laboratory tests on a 30-in. by

A Twin 48-in. by 48-in. by 36-ft. Laminex Culvert Installed on a Railroad to Replace an Old Trestle

24-in. rectangular Laminex culvert showed that it withstood a concentrated load of 20,000 lb. per lin. ft. without any failure. Rectangular Laminex culverts can also be assembled and installed in special designs, such as broken back, drop inlet, and flume types, for special conditions.

Permaflex for Floor Repairs

THE Permaflex Products Company, Philadelphia, Pa., has introduced into the railroad field a new floor patching and resurfacing material, known as Permaflex. This product is described as a rubbery-textured mineral and chemical compound, brown in color, and is used as an admixture with the aggregates employed in making concrete. It is claimed that this material is suitable for patching or resurfacing all types of floor surfaces, including concrete, wood, metal, brick or stone, and that it is equally suitable for either interior or exterior use.

It is said that Permaflex produces a hard wear-proof surface that is unaffected by changes in temperature or by loads on truck wheels up to 3,000 lb. per sq. in. Other claims made for the material are that it will not pulverize or crumble, that it is not slippery, either wet or dry, that it is waterproof and easily cleaned, and that it is fireproof.

To patch or resurface an old floor with the new material, the surface on which it is to be applied is first cleaned thoroughly, after which a bonding coat, also of Permaflex, is applied. The resurfacing material is then applied and troweled to the desired surface. It is said that Permaflex floors are ready for foot traffic in 6 to 12 hr. and for heavy traffic in 24 to 48 hr., depending on the drying conditions. One cement finisher and three laborers, it is said, can install 1,000 sq. ft. of this type of floor in eight hours.

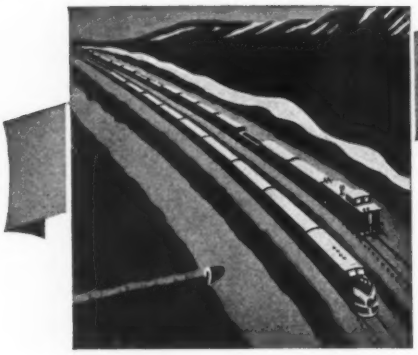
Belt Pulley for Motor Cars Prevents Slippage

A new drive axle belt pulley designed to prevent slippage in weeds and snow has been developed by Fairmont Railway Motors, Inc., for use on cars in territories where deep snow or tall weed growths are prevalent. The belt contact surface of the pulley consists of blades of mild steel which are cast solidly into the hub to insure permanency. The blades are flanged at the ends to prevent any possibility of the belt slipping off. The pulleys are made in several diameters, with the hubs bored to sizes to fit drive axles of the various types of Fairmont motor cars.

It is said that with this type of

The New Fairmont Pulley Is Designed to Prevent Weeds, Snow or Ice Becoming Lodged Between the Belt and the Pulley.

pulley, it is not possible for weeds, snow, ice or similar foreign matter to become lodged between the belt and the drive pulley, thus causing the belt of the motor car to slip.



NEWS of the Month

Priorities System to Be Succeeded By Allocation

Increased use of allocation orders and thus a diminishing need for preference rating certificates was predicted in a September 28 statement from Donald M. Nelson, director of priorities, Office of Production Management. The allocation orders involve a direct allocation of materials; or, as Mr. Nelson put it, they are instructions "as to how much of what can be shipped to whom," thus providing "a clear-cut and exact way of dividing up any given scarce material." He acknowledged that "the priorities system caused some hardships," and promised to try, "in anything we do, to avoid causing any hardships which can be avoided." Meanwhile, any changes "will be worked out gradually, over a period of time"; and "the priorities instruments used now will continue to be used as parts of the system." Mr. Nelson also revealed that with the increased emphasis on allocations there will come a like emphasis on classification of end uses of materials "in accordance with the interest of defense."

Great Lakes Ore Traffic Blocked by Bridge Collapse

On October 7, the northern arm of a single track Canadian Pacific bascule lift bridge of the two-leaf Strauss trunnion type over the St. Mary's Falls canal at Sault Ste. Marie, Mich., collapsed under the locomotive, tender and one car of a 35-car freight train en route from Canada. The locomotive and tender fell through the open end of the north leaf of the bridge into the canal, drowning the engineer and conductor, who were trapped in the cab of the locomotive.

The accident blocked the entrance to the two largest locks of the St. Mary's Falls canal connecting Lake Huron and Lake Superior, these locks were the only ones which permitted the passage of fully loaded ore carriers. Within 45 hours after the accident, military authorities had succeeded in raising both leaves of the span and in moving the locomotive and tender to clear the south half of the channel. Boat movements guided by tugs at restricted speed were then resumed.

The bascule span which failed was 336 ft. long and was built in 1914. Examination and repeated test operation of the structure after the accident failed to disclose the circumstance or combination of circumstances that could have allowed the north leaf to lower beyond its normal closed and locked position, in the face of testimony by the bridge operator that the controls of the bridge functioned normally, and supplementary eye witness testimony that a green proceed signal immediately beyond the bridge indicated that it was in fully locked position, ready for rail traffic.

Railroads Co-operate With Army in Maneuvers

Close co-operation between the Military Transportation Section of the Association of American Railroads and the commercial traffic branch of the Office of the Quartermaster General speeded the transportation of troops and supplies by rail during the Third Army maneuvers, between July 29 and October 2 at New Orleans, according to a report of the Quartermaster General to the War Department, which states, "At no time during the maneuvers did the Army experience any delay due to a shortage of rail equipment."

At the same time the War Department announced that the movement of U. S. Army personnel by rail during the month of September involved 132,458 persons. This transportation was directed by the commercial traffic branch of the Office of the Quartermaster General in co-operation with the military transportation section of the A. A. R.

Railroad equipment used included 341 special trains, 1,858 sleeping cars, 1,502 coaches, 342 baggage cars, 263 baggage cars for kitchens, 133 box cars, 636 flat and gondola cars, and 126 open cars.

Railroads Must Have Materials for Equipment

Chairman Lea of the House of Representatives committee on Interstate and Foreign Commerce suggested in a September 25 speech that because transportation "is the basic activity on which other defense successes must rest, every effort possible should be made to supply that deficiency in materials for which priorities have not been granted." Mr. Lea stressed the need for co-operation in the interest of efficient utilization of existing equipment, continuing then with his plea for priorities which will be effective in making available the materials needed for car and locomotive construction. In that connection he mentioned figures which have been given by Defense Transportation Commissioner Ralph Budd, showing that the present building program is already 20,000 cars behind schedule, and that it will fall short by 100,000 cars by October 1, 1942, "unless needed construction materials can be provided in the near future." Concluding, Mr. Lea said: "There will always be the opportunity to improve the service by use of equipment in existence, but transportation cannot be increased through any degree of efficiency by equipment ordered but not in use."

Emergency Board Will Report on November 5

The five-man Emergency Board appointed by President Roosevelt, after efforts to mediate the railroad wage controversy failed, concluded its hearings on October 22 and retired to digest the vast volume of testimony presented by the railways and brotherhoods and to prepare its report to the President. The date for presentation of its recommendations for settlement of the dispute has been extended from November 1 to November 5. The issues at stake and the personnel of the Emergency Board were reported in the September and October issues.

No Car Shortage This Fall

In an informal talk at an October 2 luncheon meeting of the Washington (D. C.) Trade Association Executives, Ralph Budd, defense transportation commissioner, predicted that there will be no serious car shortage this fall. In making this prediction, Mr. Budd conceded that here and there cars of a particular type might not be placed the minute they are needed; but there will be "no interference with defense or civilian activities." Recent loading figures make it appear to Mr. Budd that estimates predicting that this fall's peak would bring a million-car week have been "quite on the optimistic side." He thinks that the estimated peak of 940,000 cars, given to him last April by M. J. Gormley, executive assistant of the Association of American Railroads, and A. A. R. Vice-President C. H. Buford, will prove about right. Just as was the situation in 1940, Mr. Budd added, the railroads will handle an increased volume of business while encountering annual peaks relatively lower than in former years. Transportation congestion during the period of the first World War, he recalled, was due to the use of cars for storage; but he pointed out that the necessity for avoiding a repetition of such conditions is now generally realized.

Personal Mention

General

John A. Gillies, general manager of the Western lines of the Atchison, Topeka & Santa Fe, vice-president of the Panhandle & Santa Fe, and an engineer by training and experience, with headquarters at Amarillo, Tex., has been called to service at Washington, D. C., as a colonel in the Army Engineering Corps.

Thomas Robertson Alexander, roadmaster on the Canadian Pacific at Fernie, B. C., has been promoted to assistant superintendent, with headquarters at Calgary, Alta. A biography of Mr. Alexander was published in the February issue, following his promotion to roadmaster on November 1, 1940.

Alonzo J. Finn, roadmaster of the Ft. Scott-Afton subdivision of the St. Louis-San Francisco, with headquarters at Ft. Scott, Kan., has been promoted to director of accident prevention, with headquarters at Springfield, Mo. Mr. Finn was graduated in civil engineering from Washington University (St. Louis, Mo.) in 1922. He first entered railway service in the engineering department of the Frisco during the summer of 1920. He also served in the engineering department at Chaffee, Mo., during the summer of 1921, and after graduation in June, 1922, began continuous service at Chaffee. In 1926 he was transferred to Ft. Scott, Kan., and in 1928 he was promoted to roadmaster on the Kansas City (Mo.) terminal. In 1938 Mr. Finn was transferred to Ft. Scott, where he remained until his recent promotion.

Stanley R. Lamb, assistant superintendent on the Canadian Pacific at Edmonton, Alta., and an engineer by training and experience, has been promoted to superintendent of the Lethbridge division, with headquarters at Lethbridge, Alta. Mr.

Stanley R. Lamb

Lamb was born at Edinburgh, Scotland, on May 26, 1884, and was educated in Edinburgh. He entered railway service on April 14, 1905, as a rodman on the Canadian Pacific, later serving as resident engineer on construction on the Western lines, both in the field and in the Winnipeg (Man.) office. From November 9, 1914, to July 18, 1919, he was engaged in military service, returning to the Canadian Pacific on the latter date as resident engineer on construction. On July 7, 1920, Mr. Lamb was appointed engineer in charge of the Edmonton, Dunvegan & British Columbia and the Central Canada (both now jointly owned by the Canadian Pacific and the Canadian National), with headquarters at Edmonton, Alta., and on November 10, 1926, he was appointed engineer on the Canadian Pacific at Winnipeg. On January 23, 1927, he was promoted to bridge and building master, with headquarters at Saskatoon, Sask., and on September 15, 1927, he was advanced to assistant superintendent at Minnedosa, Man., later being transferred successively to Wynard, Sask., Kenora, Ont., Weyburn, Sask., and Edmonton. His promotion to superintendent was effective October 1.

Robert E. Woodruff, co-trustee and chief executive officer of the Erie, and an engineer by training and experience, has been elected president and a director of

Robert E. Woodruff

the newly reorganized company. Mr. Woodruff was born on a farm near Green Bay, Wis., on September 11, 1884, and was graduated in civil engineering from Purdue University. He entered railway service in June, 1905, as a section laborer on the Erie, and thereafter served successively as a section foreman, transitman, construction engineer, assistant division engineer, division engineer and trainmaster until March, 1909, when he was promoted to general agent, operating department, on the Chicago Terminal. He was advanced to division superintendent, with headquarters at Rochester, N. Y., in December, 1910, and later was promoted successively to superintendent of transportation, general superintendent of the lines West, and manager of the Hornell region. On February 15, 1927, he was appointed general manager of the Eastern district, with headquarters at Hornell, N. Y., and on December 1, 1928, he was promoted to assistant vice-president, with headquarters at New York. Mr. Woodruff was elected vice-president in charge of maintenance and operation, with headquarters at New York, on May 24, 1929, and his headquarters were later transferred to Cleveland, Ohio. On October 27, 1939, he was appointed co-trustee and chief executive officer, with headquarters as before at Cleveland.

Earl Sullivan, superintendent of the Palestine-San Antonio divisions of the International-Great Northern (part of the

Earl Sullivan

Missouri Pacific Lines), with headquarters at Palestine, Tex., and an engineer by training and experience, has been promoted to general superintendent of transportation of the Missouri Pacific Lines, with headquarters at St. Louis, Mo. Mr. Sullivan was born at Riverside, Cal., on January 11, 1888, and graduated from Washington and Lee University. He entered railway service on July 26, 1909, as a track apprentice on the Missouri Pacific at Sugar City, Colo., later serving successively as a rail inspector at Union, Neb., rodman at Atchison, Kan., assistant on the engineering corps at St. Louis, ballast inspector at Monticello, Ark., instrumentman at Falls City, Neb., and engineer in charge of second track work at Omaha, Neb. In April, 1913, Mr. Sullivan was appointed assistant engineer at Falls City, Neb., and in April 1917, was transferred to St. Louis. In June, 1920, he was promoted to division engineer at Coffeyville, Kan., and in July, 1925, he was advanced to trainmaster at Arkansas City, Kan. He was transferred to Hoisington, Kan., in 1928 and in January, 1929, he was promoted to assistant superintendent at Pueblo, Colo. Mr. Sullivan was advanced to district engineer, with headquarters at Kansas City, Mo., in May, 1933, and in January, 1938, he was appointed division superintendent, with headquarters at Coffeyville. He was transferred to Palestine, Tex., in May, 1941.

Robert C. White, assistant general manager on the Missouri Pacific, with headquarters at St. Louis, Mo., and an engineer by training and experience, has been promoted to chief operating officer, with the same headquarters. Mr. White was born at Bertrand, Mo., on February 8, 1881, and attended Southeast Missouri Teachers' College, Missouri University and the United States Military Academy. He entered railway service in 1905 as an assistant on the engineering corps of the Missouri Pacific at St. Louis, and in 1906 he was promoted to assistant division engineer at Sedalia, Mo. In 1907 and 1908 he served as roadmaster on various divi-

sions, and from 1908 to 1912 he served as division engineer on various divisions. In 1913 Mr. White was advanced to district engineer, with headquarters at Little Rock, Ark., and in 1917 he was promoted to superintendent of the Memphis divi-

Robert C. White

sion. From July, 1917, to November, 1917, he served as engineer of construction for the War Department on the construction of Camp Pike, Ark., and during the period of federal control of the railroads he served as assistant chief engineer of the Missouri Pacific. In January, 1921, he was promoted to general superintendent of the Eastern district, with headquarters at St. Louis, and in 1924, he was appointed engineer of maintenance of way and structures for the system. In March, 1925, Mr. White was appointed assistant general manager, which position he held until his recent promotion.

Engineering

A. C. Clarke, chief engineer of the Baltimore & Ohio, has been appointed also consulting engineer of the Baltimore & Ohio Chicago Terminal.

H. D. Stowe, supervisor of track of the Delmarva division of the Pennsylvania, with headquarters at Clayton, Del., has been appointed assistant engineer in the office of the chief engineer maintenance of way of the New York zone.

L. N. Riggan, assistant engineer on the Seaboard, with headquarters at Norfolk, Va., has been promoted to engineer of construction, with the same headquarters, succeeding **H. S. Thomas,** whose retirement on September 30 is reported elsewhere in these columns.

H. D. Stowe, supervisor of track on the Delmarva division of the Pennsylvania, with headquarters at Clayton, Del., has been appointed assistant engineer in the office of the chief engineer maintenance of way of the New York zone, with headquarters at New York.

H. M. Stout, assistant valuation engineer of the Northern Pacific, has been promoted to valuation engineer, with headquarters as before at St. Paul, Minn. Mr. Stout advances to a position which has been vacant since the death of **Adelphus C. Terrell,** valuation engineer, on May 10, 1935. The position of assistant valuation engineer has been discontinued.

W. H. Lowther, who resigned last spring as division engineer of the Colorado division of the Union Pacific, with headquarters at Denver, Colo., and went with the Denver & Rio Grande Western as engineering assistant at Denver, has returned to the Union Pacific as division engineer at Denver.

Wendell Fields, office engineer of the Gulf Coast Lines and the International Great Northern, with headquarters at Houston, Tex., has been promoted to assistant chief engineer of the International Great Northern, a newly created position, with headquarters at Palestine, Tex.

Herbert E. Brink, chief draftsman of the New York, New Haven & Hartford, with headquarters at New Haven, Conn., has been appointed construction engineer, with the same headquarters. **Harold St. Clair McIntosh,** draftsman, has been appointed chief draftsman in the office of engineer of structures and design. Mr. Brink was born on May 19, 1882, at Montague, N.J., and entered railroad service as draftsman in the engineering department of the New Haven at New York on September

Herbert E. Brink

10, 1908. In June, 1912, he was appointed resident engineer, becoming assistant engineer in March, 1916, and general assistant engineer on June 16, 1926. He was appointed chief draftsman on March 1, 1933, the position he held until his recent appointment as construction engineer.

Albert F. Ewert, whose promotion to division engineer of the Oklahoma division of the Atchison, Topeka & Santa Fe, with headquarters at Arkansas City, Kan., was reported in the October issue, was born at Newton, Kan., on April 11, 1902, and attended Bethel College at Newton from 1921 to 1924 and Kansas University from 1927 to 1930, graduating in civil engineering from the latter institution. He entered railway service in 1919 as a blacksmith helper in the mechanical department of the Santa Fe at Newton, later working as a boilermaker helper. While going to college at Newton, he worked nights as assistant baggageman and in the freight house as a trucker. In April, 1925, he started in the engineering department of the Santa Fe at Newton and continued during the summers while attending Kansas University. In August, 1932, Mr. Ewert was furloughed and worked in the engineering department of the Socony Vacuum Oil Co., at Wichita, Kan., until March, 1935, when he was recalled to the Santa Fe division engineering department at Newton. In September, 1938, he was promoted to transitman on the construction of Diesel facilities at the 18th Street yards, Chicago, and one month

Albert F. Ewert

later he was advanced to roadmaster at Ottawa, Kan. Mr. Ewert was transferred to Chillicothe, Ill., in July, 1939, and in March, 1941, he was promoted to transportation inspector at Arkansas City, which position he held until his recent promotion.

A. B. Stone, bridge engineer of the Norfolk & Western, with headquarters at Roanoke, Va., has been promoted to assistant chief engineer, with the same headquarters. **W. L. Young,** crossing engineer, has been appointed bridge engineer, to succeed Mr. Stone. **H. F. Smith,** resident engineer, has been appointed crossing engineer, to succeed Mr. Young. **C. W. Noel,** chief clerk, has been promoted to office engineer. The headquarters of all the above are at Roanoke. The position of chief clerk has been discontinued.

Mr. Stone entered the service of the Norfolk & Southern in July, 1912, as a draftsman in the office of the chief engi-

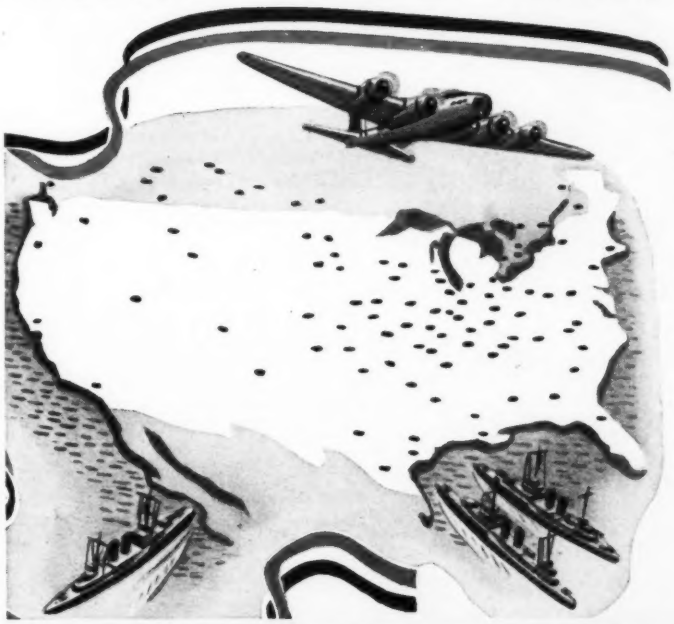
A. B. Stone

neer. On February 1, 1929, he was promoted to chief structural draftsman, and in November, 1930, Mr. Stone was appointed bridge engineer, the position he held until his recent promotion. His work will include the designing and supervision of the construction of the railway's large low-level lake-type coal pier No. 5, at

(Continued on page 832)

To build this drainage ditch, 150,000 yards of dirt and rock had to be excavated. International TD-14 TracTracTor with bull-grader, owned by the Texas Mexican Railroad Co., Laredo, Texas, shown clearing the way for the shovel.

Tractor Service "Bases"—Coast to Coast



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Lambert Point (Norfolk, Va.); the design of the company's large warehouses at Norfolk; the renewal of many important bridges, and the construction of large shop and terminal buildings over the system.

Mr. Young began work in the drafting room of the Virginia Bridge & Iron Company in June, 1918, and later served several years as draftsman, designer and construction engineer for the Atlantic Bridge Company, Greensboro, N.C. He entered the service of the Norfolk & Western in February, 1924, as a drafts-

W. L. Young

man, at which time he was employed in designing many important structures and grade crossing elimination projects. On October 16, 1930, he was promoted to crossing engineer, the position he held until his recent promotion.

H. S. Thomas, engineer of construction of the Seaboard, with headquarters at Norfolk, Va., retired from service on September 30. Mr. Thomas was born at Berryville, Va., and attended Shenandoah University School, Berryville, Va., and the University of Virginia. After working for more than 10 years on the Norfolk & Western, the Atlantic Coast Line, the West Virginia Central & Pittsburgh (now the Western Maryland), the Mobile & Ohio (now part of the Gulf, Mobile & Ohio), the Louisville & Nashville and the Virginian, he entered the service of the Seaboard Air Line in 1903 as a division engineer, later being appointed successively locating engineer, engineer in charge and engineer of construction. In 1927 he was promoted to chief construction engineer, with headquarters at Norfolk and on May 1, 1930, his title was changed to engineer of construction.

R. E. Nottingham, assistant engineer, miscellaneous accounts, in the office of the chief engineer of the Louisville & Nashville at Louisville, Ky., has been appointed assistant division engineer, with headquarters at Birmingham, Ala. **W. E. Quinn,** assistant engineer at Ravenna, Ky., has been appointed assistant engineer at Louisville, succeeding Mr. Nottingham and **C. W. Wilson,** assistant engineer at Louisville, has been transferred to Ravenna, replacing Mr. Quinn. **G. R. Sproles,** draftsman in the bridge department at Louisville, has been appointed assistant engineer at that point.

Mr. Nottingham was born at Colsbrook, Ohio, on June 30, 1891, and studied engineering at Denison University, Granville, Ohio, and the Chicago Central State Institute. He began work with the E. W. Clark Mining Corporation, Columbus, Ohio, in July, 1914, as a power engineer and during the first World War entered the U. S. Officers Training Corps as a private, later serving successively as a second lieutenant and first lieutenant with the U. S. Engineers. After the war he entered railroad service as an instrumentman on the L. & N., later being promoted to assistant engineer and serving in this capacity at various places on the system and in the chief engineer's office.

Edward L. Gosnell, principal assistant engineer of the Baltimore & Ohio, has been promoted to assistant chief engineer, with headquarters as before at Baltimore, Md. The positions of assistant chief engineer at Pittsburgh (Pa.) and principal assistant engineer have been abolished. **Richard Mather,** assistant to the chief engineer, with headquarters at Baltimore, has been advanced to engineer of construction, with the same headquarters. **Robert E. Kennedy** has been appointed assistant to the chief engineer at Baltimore, succeeding Mr. Mather. **William W. Gwathmey, Jr.,** assistant engineer at Clarksburg, W. Va., has been promoted to district engineer, with headquarters at Baltimore, a newly created position. **Karl J. Wagoner,** assistant engineer at Pitts-

Edward L. Gosnell

burgh and **James P. Ray,** assistant engineer at Cincinnati, Ohio, have also been advanced to district engineers, with same headquarters, two newly created positions.

Mr. Gosnell was born on August 17, 1887, at Granite, Md. He received his higher education at St. Johns College, Annapolis, Md., and on September 12, 1906, he entered railway service with the Baltimore & Ohio. He was engaged continuously in construction work until 1914, when he severed his connection with the Baltimore & Ohio. In February, 1916, he re-entered the service of that road and, until December, 1918, served successively as resident engineer, assistant engineer and office engineer at Cincinnati, Ohio. In December, 1918, he was promoted to assistant to chief engineer at Baltimore, which position he held until October, 1930, when he was advanced to principal assistant engineer, the position he held until his recent promotion.

Mr. Mather was born on October 3, 1877, at New Haven, Conn., and was graduated from Yale University in 1897 with a Ph.D. in civil engineering. He entered railroad service in 1898 as axeman with the Chicago & Western (abandoned), and from January, 1902, to October, 1903, he served as transitman, resident engineer and assistant engineer, successively, for the Chicago Great Western. From October, 1903, to August, 1905, Mr. Mather served as draftsman and assistant engineer for the Chicago, Burlington & Quincy, at Chi-

Richard Mather

cago, going to the Erie on the latter date in charge of location and construction of the Genesee River railroad and other construction projects. In August, 1911, Mr. Mather entered the service of the Baltimore & Ohio as assistant engineer, and later served as district engineer at Huntington, W. Va., being transferred to Baltimore in May, 1918. On June 1, 1927, he was promoted to assistant to chief engineer, with headquarters at Baltimore.

Track

W. A. Moberly, extra gang foreman on the Chicago, Milwaukee, St. Paul & Pacific, has been promoted to roadmaster, with headquarters at Chillicothe, Mo., succeeding **E. Schoech,** who has been assigned to other duties.

Abner Hamm has been appointed acting roadmaster in charge of the 12th track division of the St. Louis-San Francisco, with headquarters at Ft. Scott, Kan., succeeding **A. J. Finn,** whose promotion to director of accident prevention, with headquarters at Springfield, Mo., is reported elsewhere in these columns.

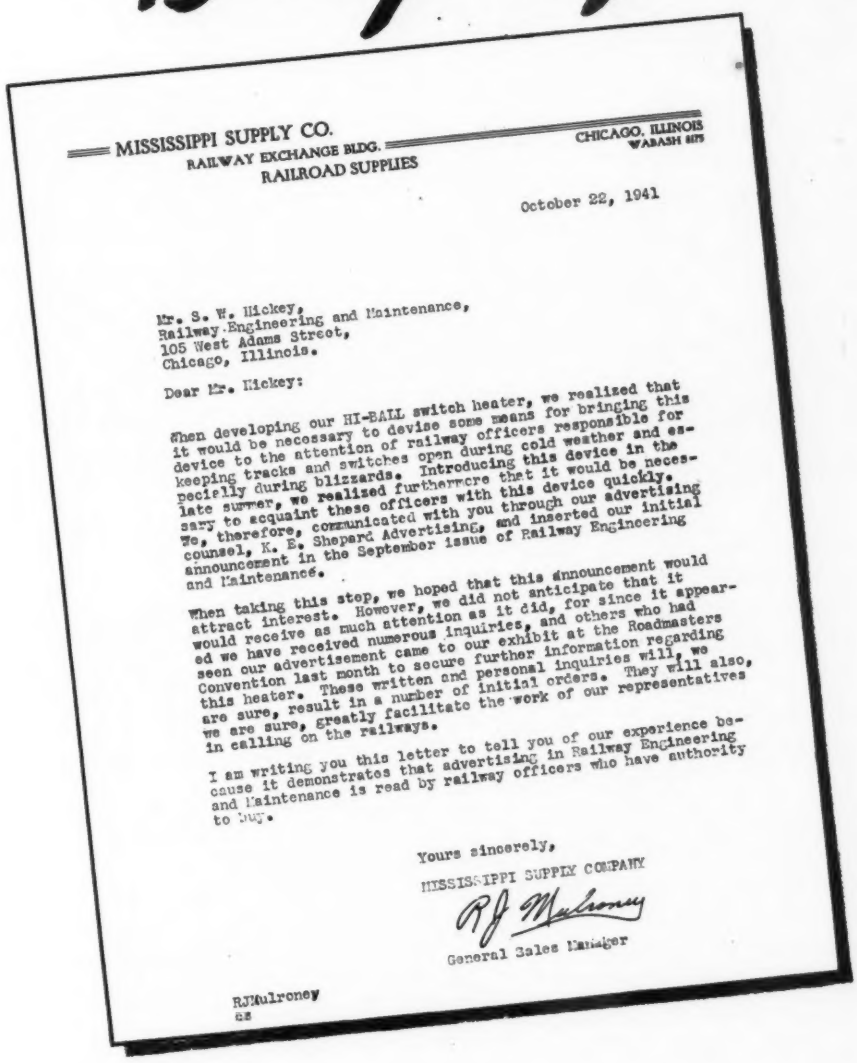
D. Z. Gardner, transitman on the Albuquerque division of the Atchison, Topeka & Santa Fe, has been promoted to roadmaster, with headquarters at Parker, Ariz., succeeding **R. A. Johnson,** who has been transferred to Needles, Cal. Mr. Johnson relieves **O. D. Hoge,** who has been transferred to Prescott, Ariz., replacing **R. D. Brown,** who retired on September 1.

John Barnes, Jr., has been appointed acting roadmaster on the Denver & Rio Grande Western, with headquarters at Pueblo, Colo., succeeding **Chris Johnson,** who was recently injured seriously. **G. S.**

(Continued on page 834)

READER INTEREST---PLUS

Buying Power



MISSISSIPPI SUPPLY CO.
RAILWAY EXCHANGE BLDG.
RAILROAD SUPPLIES

CHICAGO, ILLINOIS
WABASH 8175

October 22, 1941

Mr. S. W. Hickey,
Railway Engineering and Maintenance,
105 West Adams Street,
Chicago, Illinois.

Dear Mr. Hickey:

When developing our HI-BALL switch heater, we realized that it would be necessary to devise some means for bringing this device to the attention of railway officers responsible for keeping tracks and switches open during cold weather and especially during blizzards. Introducing this device in the late summer, we realized furthermore that it would be necessary to acquaint these officers with this device quickly. We, therefore, communicated with you through our advertising counsel, K. E. Shepard Advertising, and inserted our initial announcement in the September issue of Railway Engineering and Maintenance.

When taking this step, we hoped that this announcement would attract interest. However, we did not anticipate that it would receive as much attention as it did, for since it appeared we have received numerous inquiries, and others who had seen our advertisement came to our exhibit at the Roadmasters Convention last month to secure further information regarding this heater. These written and personal inquiries will, we are sure, result in a number of initial orders. They will also, we are sure, greatly facilitate the work of our representatives in calling on the railways.

I am writing you this letter to tell you of our experience because it demonstrates that advertising in Railway Engineering and Maintenance is read by railway officers who have authority to buy.

Yours sincerely,
MISSISSIPPI SUPPLY COMPANY
RJ Mulroney
General Sales Manager

RJMulroney
ss

The above letter speaks for itself.—You too can increase your sales by displaying your products in the advertising pages of Railway Engineering & Maintenance.—Read by men who, this year, are responsible for the specification and purchase of Engineering and Maintenance of way materials and equipment valued at more than $400,000,000.

RAILWAY ENGINEERING AND MAINTENANCE

A SIMMONS-BOARDMAN PUBLICATION
105 W. Adams St. - - 30 Church St.
CHICAGO - - NEW YORK

Turner has been appointed roadmaster, with headquarters at Helper, Utah, relieving **G. B. Aydelott,** who has been transferred to the Denver & Salt Lake, between Denver, Colo., and Orestod.

L. W. Moss, supervisor of track on the New York Central (Big Four) at Galion, Ohio, has been transferred to Bellefontaine, Ohio, succeeding **G. F. Borgman,** who retired on October 31, and **Ira Walker,** supervisor of track at Anderson, Ind., has been transferred to Galion, relieving Mr. Moss. **W. A. Summers,** section foreman, has been promoted to supervisor of track at Harrisburg, Ill., replacing **C. V. Talley,** whose transfer to Anderson, Ind., was reported in the October issue.

Mr. Walker, whose promotion to supervisor of track at Anderson, was reported in the October issue, was born at New Market, Ind., on August 14, 1888, and entered railway service on August 1, 1904, as a section laborer on the Big Four at Milroy, Ind. On May 1, 1911, he transferred to the transportation department as a locomotive fireman and on July 1, 1913, returned to section work. Mr. Walker was promoted to section foreman at Milroy on August 6, 1916, and on September 1, 1935, he was transferred to Wabash, Ind. He was appointed acting supervisor of track at Wabash on June 15, 1941, and on September 1, he was advanced to supervisor of track at Anderson.

T. F. Langan, supervisor of track on the Delaware, Lackawanna & Western, with headquarters at Hoboken, N.J., has resigned to accept a similar position on the Central Railroad of New Jersey at Jersey City, N.J., where he succeeds **Carl H. Vogt,** whose promotion to assistant division engineer was noted in the August issue. **E. T. Anderson,** chief clerk to the supervisor of track of the Jersey Central at Mauch Chunk, Pa., and formerly assistant supervisor of track, has been promoted to assistant supervisor of track, with headquarters at Long Branch, N.J., succeeding **Calvin J. Langenbach,** whose promotion to supervisor of track at Somerville, N.J., was reported in the August issue.

Thomas Wilbur Hicks, whose promotion to roadmaster on the Canadian Pacific, with headquarters at Princeton, B.C., was reported in the September issue, was born at Winnipeg, Man., on March 26, 1897, and entered railway service on September 1, 1923, as a chainman in the construction department of the Canadian Pacific at Winnipeg, later being promoted through various positions to resident engineer. In 1935, he was appointed transitman on the Esquimalt & Nanaimo (leased to the Canadian Pacific) at Victoria, B.C., and the following year he returned to the Canadian Pacific as transitman at Kenora, Ont., later being transferred to Calgary, Alta., and Penticton, B.C. Mr. Hicks was located at Penticton at the time of his recent promotion.

H. W. Martens, assistant supervisor of track on the Pennsylvania, with headquarters at New Brunswick, N.J., has been promoted to supervisor of track with headquarters at Clayton, Del., succeeding **H. D. Stowe,** whose appointment as assistant engineer is noted elsewhere in these columns. **S. C. Jannotti,** general foreman at Waverly, N.J., has been promoted to assistant supervisor of track at Jersey City, N.J., to succeed **Stuart Shumate,** who has been transferred to New Brunswick to replace Mr. Martens.

A. W. Schroeder, track supervisor on the Kenesaw-Oxford line of the Chicago, Burlington & Quincy, has been promoted to roadmaster, with headquarters at Central City, Neb., succeeding **M. G. Counter,** who has been transferred to So. Sioux City, Iowa, replacing **H. C. Arnold.** Mr. Arnold has been transferred to Oxford, Neb., relieving **W. F. Jarl,** who has been transferred to McCook, Neb., succeeding **M. W. Stevens.** Mr. Stevens has been transferred to Denver, Colo., replacing **T. V. Ross,** whose death on October 7 is reported elsewhere in these columns.

Arthur K. Howe, assistant supervisor of track on the Pennsylvania, who has been promoted to supervisor of track, with headquarters at Wheeling, W. Va., as reported in the September issue, was born on March 19, 1912, at Buffalo, N.Y. Mr. Howe attended Yale university, graduating in civil engineering in 1934. He entered railway service on June 25, 1934, as an engineering apprentice on the Pennsylvania. In January, 1935, he became an assistant on the engineering corps, serving in this capacity at various points until December, 1936, when he was advanced to assistant supervisor of track. In May, 1938, he returned to the position of assistant on the engineering corps, and in August of the same year he was appointed inspector of bridges and buildings, with headquarters at Buffalo, again becoming assistant on the engineering corps in December, 1938. In June, 1939, he was promoted to assistant supervisor of track, with headquarters at Harrisburg, Pa.

Obituary

T. V. Ross, roadmaster on the Chicago, Burlington & Quincy at Denver, Colo., died suddenly of a heart attack on October 7.

Walter G. Stewart, former supervisor of bridges and buildings on the Louisville & Nashville at Nashville, Tenn., who retired on July 1, 1937, died on August 7.

F. A. Feikert, division engineer of the Salt Lake division of the Southern Pacific, with headquarters at Ogden, Utah, died on September 27, when he fainted or became ill while traveling on a motor car and fell from the car as it was passing over a bridge.

Joseph A. Parant, assistant to the chief engineer of the Boston & Maine, whose death at Wolfeboro, N.H., on September 22, was reported in the October issue, was born at Lawrence, Mass., and attended the Massachusetts Institute of Technology. Mr. Parant first entered the service of the Boston & Maine in June, 1903, as a water boy. Subsequently, he was advanced through various positions in the engineering department, being appointed engineer of standards on April 1, 1927. On November 1 of the following year, he became principal assistant engineer, and on February 1, 1939, he was appointed assistant to the chief engineer, the position he held at the time of his death.

Association News

Bridge and Building Association

President R. E. Dove has called a meeting of the executive committee in Chicago on December 1, to organize in detail the work of the association during the coming year.

Roadmasters' Association

Upon the call of A. B. Hillman, president, the executive committee will meet in Chicago on December 8, to select the personnel of committees and to plan the work of the association for the year ahead.

Wood-Preservers' Association

The executive committee met in Chicago on Wednesday, October 15, to perfect plans for the thirty-eighth annual convention of the association to be held at the Hotel Nicollet, Minneapolis, Minn., on January 27-29, 1942.

Metropolitan Maintenance of Way Club

With 70 members and guests present, the club held its first meeting of the season at the Governor Clinton Hotel, New York, on October 23. Following dinner, the meeting was addressed by S. R. Hursh, chief engineer maintenance of way, Pennsylvania, Eastern region, who discussed the problems encountered in rehabilitating heavy-tonnage freight tracks; and by W. E. Gadd, of the Rail Joint Company, who spoke on the use of the Polariscope in the design of rail joints. The program also included the showing of a motion picture that was taken at the annual outing of the club in June, 1941.

Maintenance of Way Club of Chicago

More than 125 members and guests were present at the first Fall meeting of the club, which was held in the Ambassador room of Huyler's restaurant in the Straus building, Chicago, on the evening of October 27. E. M. Hastings, chief engineer, Richmond, Fredericksburg & Potomac, Richmond, Va., discussed What Lies Ahead, with special emphasis upon what faces maintenance of way forces in the days of national emergency which lie ahead. The next meeting of the club, to be held on November 24, will be addressed by R. H. Carter, division engineer, Illinois Central, on Organizing for High-Speed Rail Laying.

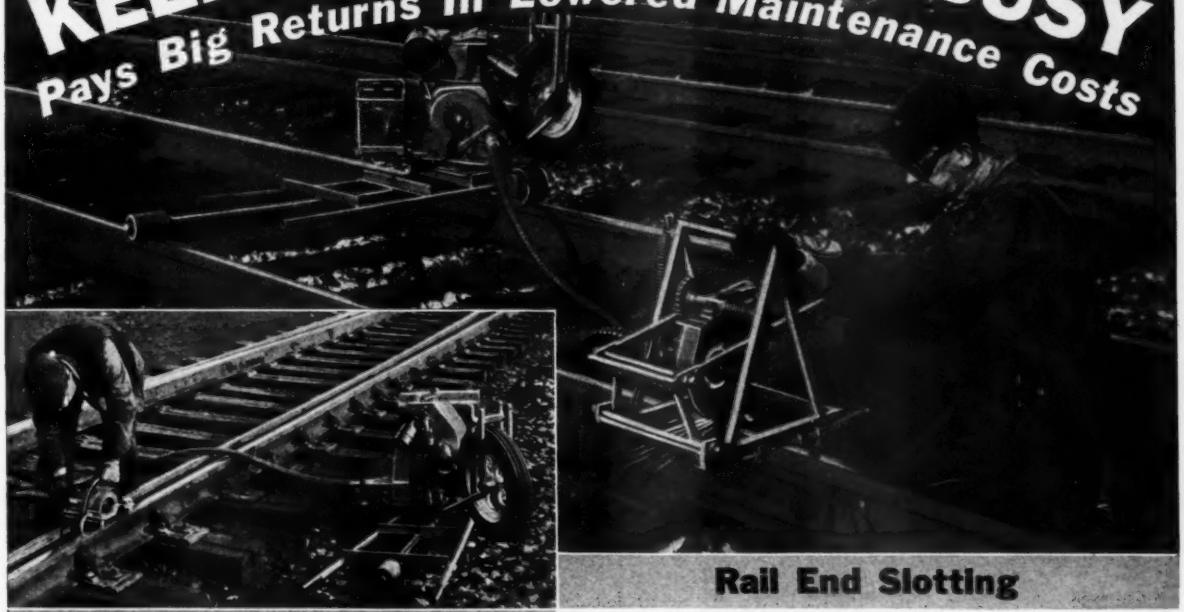
American Railway Engineering Association

The Board of Direction and the Nominating committee of the association will meet in Chicago on November 14. In addition, the four following standing committees have scheduled meetings during November: Wood Preservation, at New York, on November 6 and 7; Track, at Chicago, on November 13; Economics of Railway Labor, at Chicago, on No-

(Continued on page 836)

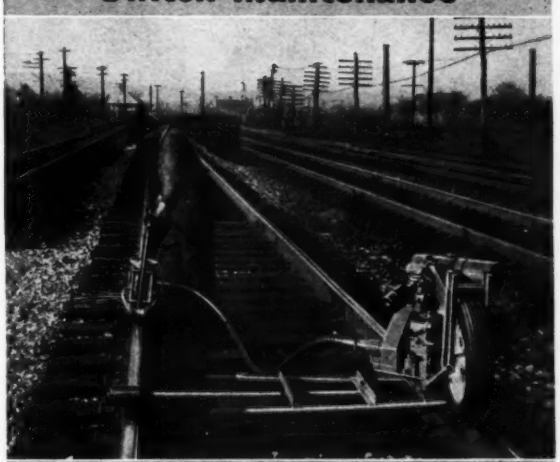
KEEP THIS GRINDER BUSY

Pays Big Returns In Lowered Maintenance Costs



Rail End Slotting

Switch Maintenance



Surface Grinding

Nordberg Tools for Maintenance

Adzing Machine	Spike Puller
Rail Drill	Power Wrench
Power Jack	Track Shifter

Six kinds of Rail Grinders

Because of the many uses to which the Nordberg Utility Grinder may be put, this tool can be kept busy and paid for out of savings. For slotting rail ends, removing flow at switches and stock rails, surfacing welded rail, grinding at frogs, crossings and flangeways, boring ties for cut or screw spikes, are but some of the many jobs for which it may be used. It can be operated from the rail or placed in the intertrack space and, since it is so easily moved from job to job, is especially adaptable around terminals, yards and in multi-track congested traffic areas. This light weight grinder is easily handled by one man, is full-revolving on its carriage and equipped with friction drive and overload release protecting the flexible shaft should the wheel become snagged. A full line of accessories has been developed, making it possible to use this tool for most every grinding job encountered in track work. The Utility Grinder does such jobs better, in less time and with less expense. Write for Bulletin 101.

NORDBERG MFG. CO. MILWAUKEE WISCONSIN

Export Representative—WONHAM Inc.—44 Whitehall St., New York

vember 14; and Masonry, at Chicago, on November 24 and 25.

Late in October, Bulletin No. 426 was mailed to members, this bulletin including four monographs and a review of the major research projects being conducted by the Engineering division of the Association of American Railroads as an aid in the solution of problems assigned to A.R.E.A. committees. The monographs are on The Influence of the Fatigue Strength of Structural Members Upon the Design of Steel Bridges, by W. M. Wilson, research professor of structural engineering, University of Illinois; Fuel Economy from the Viewpoint of the Water Engineer, by R. C. Bardwell, superintendent water supply, Chesapeake & Ohio; Foundation Consciousness, by E. R. Lewis, retired office engineer, Michigan Central; and The Relation of Transition Curves to Speed and Superelevation, by O. E. Selby, retired principal assistant engineer, Cleveland, Cincinnati, Chicago & St. Louis.

Bulletin No. 427 is now ready for the printer, and will be mailed to members during the month. This bulletin will include the reports of seven standing committees to be presented at the annual convention next March, as follows: Railway Location and Operation; Uniform General Contract Forms; Standardization; Signals and Interlocking; Electricity, Waterways and Harbors; and Water Service, Fire Protection and Sanitation.

Eight committees held meetings during October, five in Chicago concurrent with the annual meeting of the American Railway Bridge and Building Association. The committees which met included the following: Masonry, at Cleveland, Ohio, on October 9 and 10; Wood Preservation, at Chicago, on October 14; Buildings, at Chicago, on October 14 and 15; Wood Bridges and Trestles, at Chicago, on October 15; Iron and Steel Structures, at Chicago, on October 16 and 17; Rules and Organization, at Chicago, on October 16 and 17; Co-operative Relations with Universities, at Evanston, Ill., on October 27; and Ties, on an inspection trip, October 30 and 31, with stops at Mt. Union, Pa., Hagerstown, Hancock and Cumberland, Md., and Greenspring, W. Va.

On October 21, at a public ceremony, which was attended by more than 100 members of the association, as well as members of other engineering societies, the association presented a tablet to the University of Illinois in recognition of Dr. A. N. Talbot's 27 years' service as chairman of the association's Committee on Stresses in Railroad Track. At the ceremony, which was held at Urbana, Ill., tribute was paid to Dr. Talbot as a man and a scientist, by H. R. Safford, executive assistant, Missouri Pacific, and a past president of the association. This main address was followed by presentation of the tablet by F. L. C. Bond, vice-president and general manager, Central region, C.N.R., and president of the A.R.E.A.

Air Conditioning Equipment.—The Worthington Pump & Machinery Corporation, Harrison, N. J., has published a 28-page illustrated bulletin devoted to this company's Carbondale line of refrigerating and air-conditioning equipment.

Supply Trade News

Personal

W. S. Carlisle, representative in charge of industrial sales for the White Lead department of the **National Lead Company,** Chicago, has retired. Mr. Carlisle, during the past year, was a vice-president of the Bridge and Building Supply Men's Association, and for a number of years served as secretary of that association.

Frank R. Wood, secretary of the **P. & M. Company, Ltd.,** Canada, at Montreal, Que., has been promoted to acting managing director, with headquarters as before at Montreal, succeeding **Gordon Willoughby Dunn,** whose death on September 14 is reported elsewhere in these columns.

Louis B. Neumiller, whose election as president of the **Caterpillar Tractor Company,** Peoria, Ill., was reported in the October issue, was born in Peoria on January 14, 1896, and entered business in 1915 as a stenographer and blue print clerk in the engineering department of the Caterpillar Tractor Company. In 1918 he was given a four-months leave of absence to serve with the United States ordnance engineering department at Alliance, Ohio, and after his return was assigned work on various assembly lines in the factory. He then returned to the engineering department as drafting room supervisor, and in 1922 he was promoted to parts manager.

Louis B. Neumiller

In 1931 he was advanced to general service manager, and in 1937 he was appointed sales manager for the Central division. Six months later he was appointed director of industrial relations, and in 1938 he was elected vice-president in charge of the service, parts, public relations and industrial relations and training departments, which position he held until his election to the presidency of the company.

J. D. Latimer, vice-president and general manager of the **International Creosoting & Construction Co.,** Galveston, Tex., has been elected president and general manager, succeeding **R. J. Calder,** president, whose death at Boerne, Tex., on June 28 was reported in the August issue. Mr. Latimer was born at Texarkana, Tex., on February 20, 1883. His early business experience was in the service of the St. Louis Southwestern, followed later by a period of service in the combined office of the Missouri Pacific and the Texas Pacific at Texarkana. In 1907 he became connected with the Texarkana plant of the International Creosoting & Construction Co., where he remained until 1915. In that year he was

J. D. Latimer

transferred to the general office at Galveston, and shortly thereafter became timber production manager. The scope of his activities was gradually enlarged until in May, 1926, he was elected vice-president and general manager of the company, the position he held until his recent promotion. During the period of N. R. A., Mr. Latimer was chairman of the code authority for the wood preserving industry.

Obituary

James T. Frame, a sales representative for **Fairbanks, Morse & Co.,** with headquarters at Chicago, died suddenly of a heart attack on September 20.

Gordon Willoughby Dunn, vice-president and managing director of the **P. & M. Company, Ltd.,** Canada, and vice-president of Engineering Materials, Ltd., with headquarters at Montreal, Que., died at his home in that city on September 14 at the age of 56. Mr. Dunn was a graduate of McGill University and was prominent in athletics, serving for many years as president of the Canadian Amateur Ski Association.

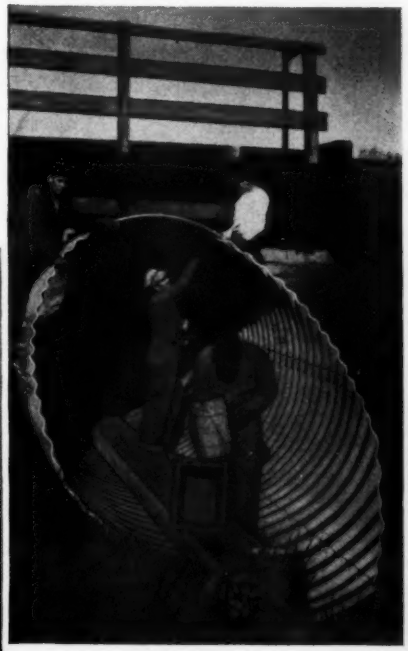
A. G. Montgomery, assistant chief engineer of the **American Steel & Wire Co.,** died in Cleveland, Ohio, on October 10. He was 54 years of age. Mr. Montgomery, a graduate of Pennsylvania State College, joined the American Steel & Wire Co. as district engineer, at Pittsburgh, Pa., in 1914. He had held a number of engineering positions with that company in Pittsburgh, and Cleveland, and was appointed assistant chief engineer in 1939.

Power Track Machines.—A new 14-page bulletin has been issued by the Railroad Accessories Corporation, New York, which describes and illustrates this company's Raco power track machine, its Raco tie boring machine and the Everett power M-W machine.

5 MEN INSTALL THIS 90-INCH CULVERT

—in 4 days!

WITH U·S·S SECTIONAL PLATES



REPLACING A SMALL BRIDGE with a 90-inch culvert built from U·S·S 7-gage Sectional Plate. Installed by Young and Greenawalt.

THIS 90-inch corrugated metal culvert replaced a failing bridge under the main line of a western railroad. The entire job — excavation, plate erection, backfilling, removal of old caps, stringers, and handrail, and placing the rip-rap headwalls—was finished in four days without stopping traffic.

This shows how U·S·S Sectional Plate construction saves time and money. A few men—and they don't need to be highly skilled—can install a culvert as strong as a small bridge. The installation was inspected carefully a year and a half after erection and found to be in perfect condition.

What's more, the cover over the pipe is small so that the top of the culvert takes a severe pounding every time a train goes over it. If highway or railway engineers have any doubts as to the strength and resistance to impact of large corrugated culverts, this, and other installations like it, should dispel any fears.

We'll gladly give you all the details of this job or answer questions about your own problems. Just write.

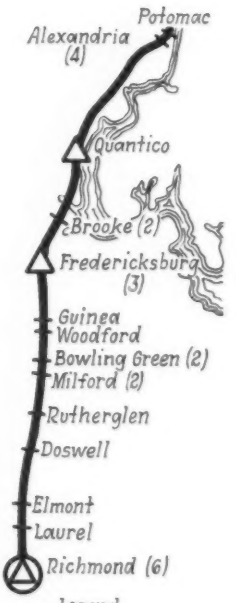
CARNEGIE-ILLINOIS STEEL CORPORATION, *Pittsburgh and Chicago*
COLUMBIA STEEL COMPANY, *San Francisco*
TENNESSEE COAL, IRON & RAILROAD COMPANY, *Birmingham*
Scully Steel Products Company, Chicago, *Warehouse Distributors*
United States Steel Export Company, New York

USS

UNITED STATES STEEL

TO RAILWAY SUPPLY MANUFACTURERS

"Can't Get Materials?"



Legend

○ General headquarters. System maintenance officers.

△ Supervisor of track headquarters

– Foreman's headquarters

Railway Engineering and Maintenance Goes Every Month to the **Chief Engineer,** to the **Assistant Engineer,** to the **3 Supervisors of Track, and to all the 27 Foremen** Who Are in Training for Promotion to Supervisory Positions on the Richmond, Fredericksburg & Potomac.

"Boss, I'm certainly looking forward to being able to stay home more this winter. It's tough to be on the road all the time," said the star railway salesman to his railway sales manager.

"What's the matter, Bill? Going to quit?" replied the sales manager.

"Hadn't thought of it, Boss."

"What do you mean by staying home then, Bill?"

"What's the use going out after orders when we can't get the materials we need to fill them?"

"Who said we can't?"

"Bill Smith of the X Company. Says he's going to save traveling expenses."

"That'll be fine for him—and for us too, Bill. We'll get his business then."

"Are *we* going to get materials?"

"Certainly—all we need to fill our *railway* orders."

"How do you figure that out, Boss?"

"That's easy, Bill. Railway orders carry priority ratings."

"Maybe they do, but the roads aren't getting materials."

"How do you know?"

"They told me so."

"How long ago?"

"About six weeks."

"That might have been true then but it isn't now. They're getting things straightened out and releases are coming through within a week now. It's a big job and there's bound to be some confusion at the start."

"Then you think we're safe in going after orders?"

"Think! Bill, I'm sure of it. The railways are among our most important agencies of national defense and the government recognizes that their maintenance is vital to our other defense activities. That's the reason the government is giving them "A" priority ratings—nearly as good as the Army and the Navy."

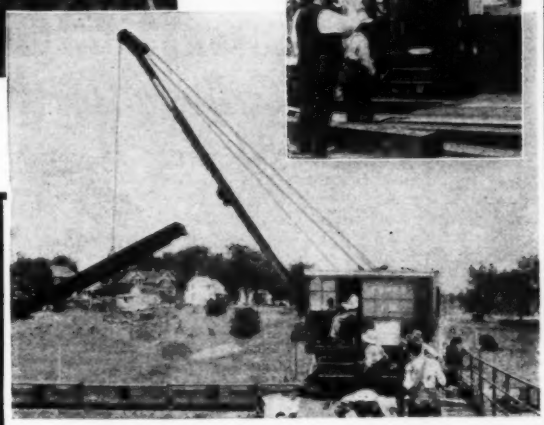
"Then it's our *duty,* Boss, to help them get our materials."

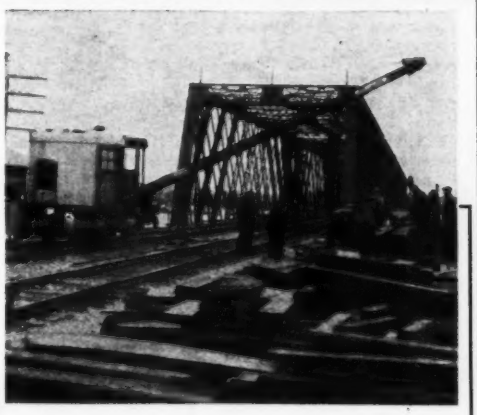
"That's the point, Bill."

"That's different. I'll get busy at once. I'll get the orders, you get the materials. And, Boss, don't let me down in our advertising in *Railway Engineering and Maintenance.* That's the best sales assistant I have. These railway men all read it and it keeps our product before them. Last week when I was on the R. F. & P. I found that every maintenance officer from chief engineer to supervisor takes that magazine—and every foreman too."

"That's certainly complete coverage, Bill. Of course, we're going to continue our advertising—a page in every issue. Next to you, it's the best agency for sales that we have."

RAILWAY ENGINEERING AND MAINTENANCE IS READ BY MAINTENANCE OFFICERS OF ALL RANKS





BURRO CRANES

A hustler on bridge work whether it is re-decking, maintenance or building, Burro Cranes switch and haul their own cars, move fast and get off the track in a hurry when necessary. Why not get information about *all* the Burro features? Write for bulletin today.

CULLEN-FRIESTEDT CO.,
1301 So. Kilbourn Ave. Chicago, Ill.

This clean treated lumber is a "natural" for shop and engine house roofs

A new installation using connector construction

A maintenance job that will stand the gaff

This year, more than ever before, railway engineers are turning to Wolmanized Lumber* for roof decking over shops and engine houses. The reasons are simple: insurance against decay, cleanliness, and freedom from corrosiveness or added fire hazard.

Where installation requirements call for clean treated wood, Wolmanized Lumber offers service-proved protection against rot and termites, plus all the desirable characteristics of untreated wood.

Wolman Salts* preservative will not corrode spikes, bolts, timber connectors, or other metal fastenings. Treatment with Wolman Salts can be had at nineteen plants located from coast to coast.

AMERICAN LUMBER & TREATING CO., CHICAGO

*Registered Trademark

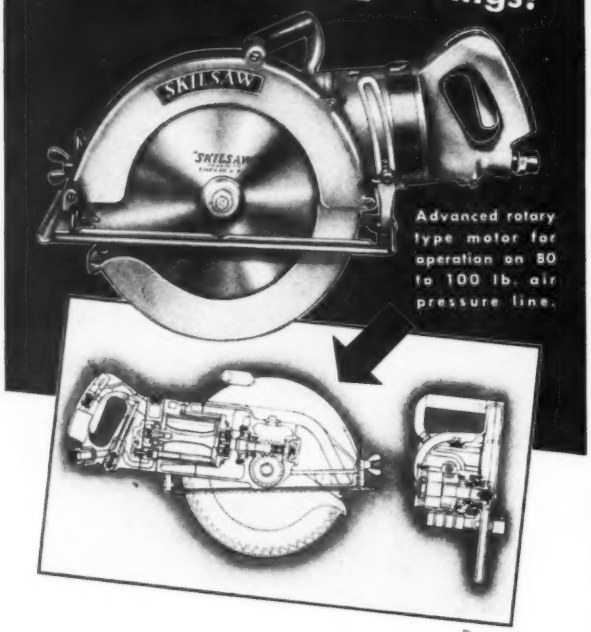
Wolmanized

LUMBER

WOLMANIZED CERTIFIED

Pneumatic SKILSAW

for faster sawing . . . easier handling . . . greater savings!



FAST, tough Pneumatic SKILSAW will bring you *big* savings on big jobs . . . and yet it weighs no more than electric saws of the same capacity. Rips and cross-cuts timbers up to 4 in. full and bevel-cuts 3-5/16 in. lumber at 45°. Perfectly balanced for easiest handling . . . perfectly powered for fastest sawing on bridges and trestles, cutting daps in ties, sawing beams and lumber for buildings and guard rails. Ideal for cutting terra cotta and building tiles.

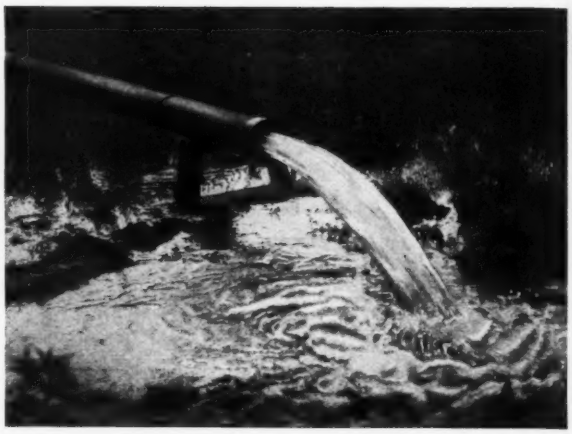
Pneumatic SKILSAW has every feature to insure long, efficient, safe operation by bridge and building crews. Leak-proof, poppet-type valve; speed governor; positive safety lock; telescoping blade guard; 12 in. blade; free-speed of blade 1200 R.P.M. Investigate Pneumatic SKILSAW today!

SKILSAW, INC.
5053 Elston Avenue, Chicago

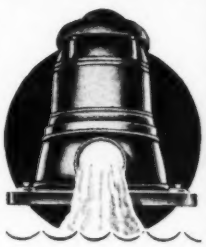
New York ● Boston ● Philadelphia ● Atlanta ● Buffalo
Cleveland ● Kansas City, Mo. ● New Orleans ● Dallas ● Los Angeles
Oakland ● Seattle ● Toronto, Canada

SKILSAW PORTABLE ELECTRIC TOOLS

YOU DISTRIBUTOR, WILL GLADLY DEMONSTRATE THIS TOOL ON YOUR OWN WORK!



A COOL MILLION
and A Half Gallons Per Day



OVER IN a certain New York town an important airplane gun manufacturer suddenly needed a lot of water for plant operation. No one knew exactly what the water bearing formations below would produce. It was no time to consider the inexperienced. Layne engineers were called in, advised of the urgency and authorized to proceed without delay. In a very few days, the job was completed; well drilled, casing set, pump installed and testing concluded—producing a cool million and a half gallons of water per day. The manufacturer was highly pleased and from somewhere a bottle of champagne was produced and a proper christening took place.

To that manufacturer a very unusual feat had been accomplished. To Layne men, it was just another in a long series of such incidents. In the present day National Defense Emergency, no Layne well water producing undertaking has met with failure. The majority have greatly exceeded the production specified.

AFFILIATED COMPANIES

LAYNE-ARKANSAS CO. . STUTTGART, ARK.
LAYNE-ATLANTIC CO. . . . NORFOLK, VA.
LAYNE-CENTRAL CO. . . MEMPHIS, TENN.
LAYNE-NORTHERN CO. . MISHAWAKA, IND.
LAYNE-LOUISIANA CO. LAKE CHARLES, LA.
LAYNE-NEW YORK CO. . NEW YORK CITY.
LAYNE-NORTHWEST CO. MILWAUKEE, WIS.
LAYNE-OHIO CO . . . . COLUMBUS, OHIO
LAYNE-TEXAS CO. . . . . HOUSTON, TEXAS
LAYNE-WESTERN CO. . KANSAS CITY, MO.
LAYNE-WESTERN CO. OF MINNESOTA MINNEAPOLIS . . . . . MINN.
LAYNE-BOWLER NEW ENGLAND COMPANY, BOSTON . . . . . MASSACHUSETTS
INTERNATIONAL WATER SUPPLY, LTD., LONDON . . . . . ONTARIO, CANADA

No firm in the Americas—north or south, is so adequately equipped or widely experienced in designing, manufacturing and installing well water systems. If you need more water, write or wire,

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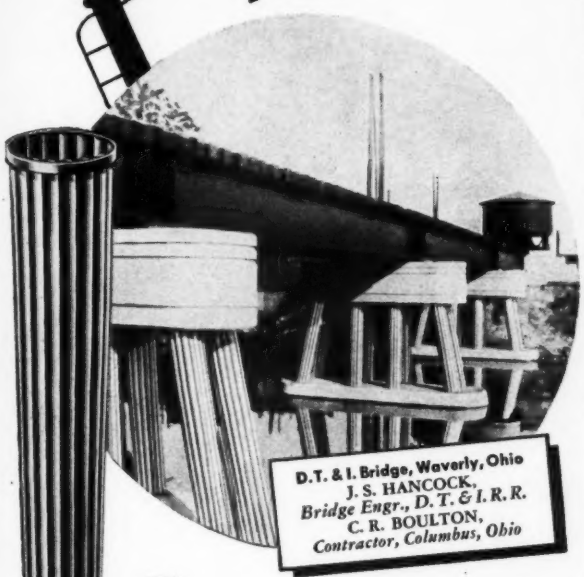

D.T. & I. Bridge, Waverly, Ohio
J. S. HANCOCK,
Bridge Engr., D. T. & I. R. R.
C. R. BOULTON,
Contractor, Columbus, Ohio

Trains traveled on schedule over this D. T. & I. Railroad bridge while Union Metal Monotubes were being installed to replace timber piling. It was done by removing a panel from the trestle, driving a portion of the 53-ft. tapered *steel* casings, then replacing the panel for the passage of trains. Despite unfavorable driving conditions, perfect alignment was obtained in all cases, including the batter piles. The finished result was a modern structure which requires less maintenance and eliminates the hazard of drift clogging the stream.

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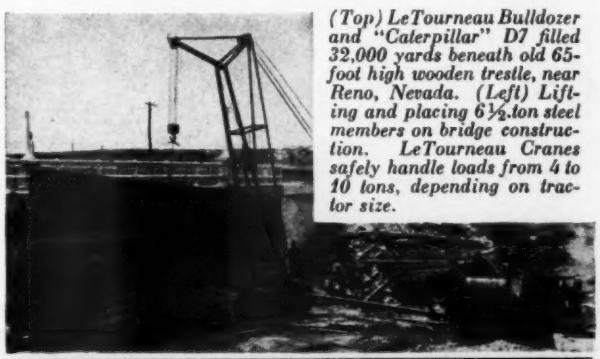
WHERE uninterrupted train schedules must be maintained, use LeTourneau earthmoving equipment for your bridge repair and grade maintenance. It works off the tracks. LeTourneau 'Dozers, for instance, quickly fill between wooden trestles, repair washouts along tracks. A LeTourneau Carryall Scraper can be used with this same 'Dozer-tractor unit for your longer haul earthmoving, to cut drainage ditches, widen banks, make curve reductions, build spur tracks and the like. All LeTourneau cable-controlled equipment is interchangeable, is operated by means of a standard Power Control Unit. Thus, you can quickly and easily change from 'Dozer or Carryall to a LeTourneau Crane—another time and money-saving tool that works off the tracks—and lift and carry heavy bridge forms on new construction, or to repair and strengthen your present trestles. It will pay you to investigate these savings. See your local LeTourneau-"Caterpillar" dealer NOW, or write us direct.



(Top) LeTourneau Bulldozer and "Caterpillar" D7 filled 32,000 yards beneath old 65-foot high wooden trestle, near Reno, Nevada. (Left) Lifting and placing 6½-ton steel members on bridge construction. LeTourneau Cranes safely handle loads from 4 to 10 tons, depending on tractor size.

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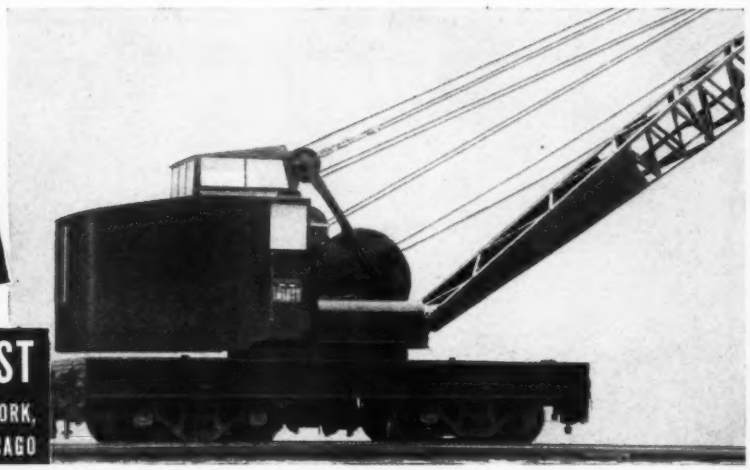

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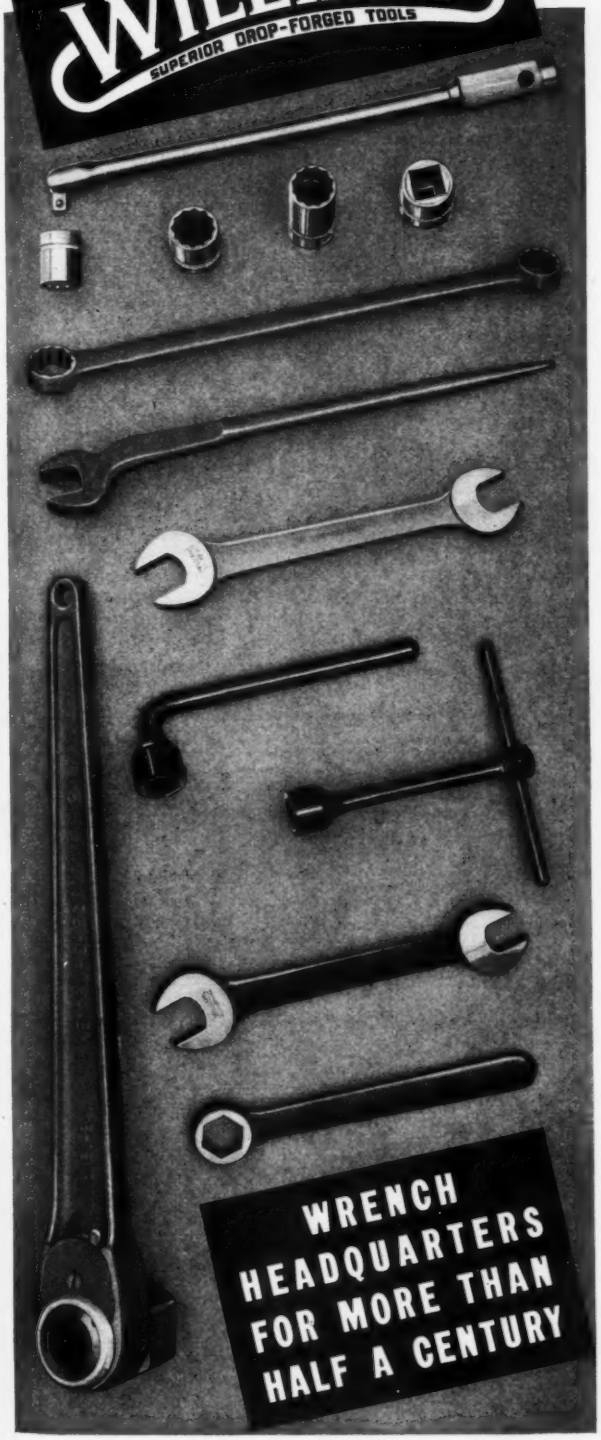

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On highways and railroads from Canada to the Gulf, Laminex has proved its ability to withstand heavy loads, roughest usage and weather, year after year, without cracking or decaying. This fact, plus low initial cost and easy installation makes Laminex the ideal material to specify for Culverts and Crossings.

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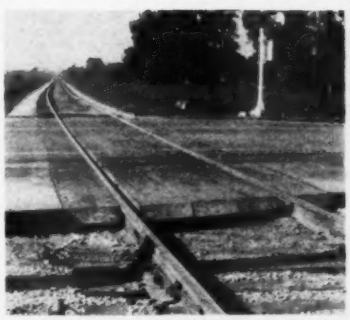

Laminex Crossings are laminated sections that join with the track to provide smooth, even riding surfaces of great load-bearing strength. As all wear is on the edge grain, the impact of passing cars actually hardens the grain. Laminex Crossings are quickly and easily installed, outwear several ordinary crossings and reduce maintenance costs substantially. Easily taken up for road repairs. Initial cost is surprisingly low.

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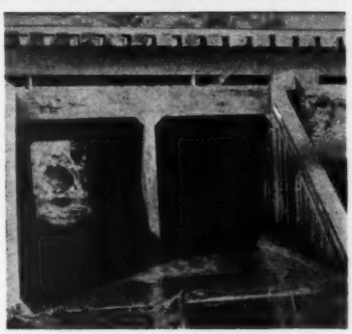
Laminex for Culverts is made into specially designed interlocking sections that enable unskilled workmen to construct snug, tight-fitting culverts of great strength and rigidity in a surprisingly short time. No nails or special tools needed. Laminex Culverts are *permanent*—don't rust, crack or decay—yet cost no more than ordinary, temporary culverts. Laminex of special design now available for Round Culverts.



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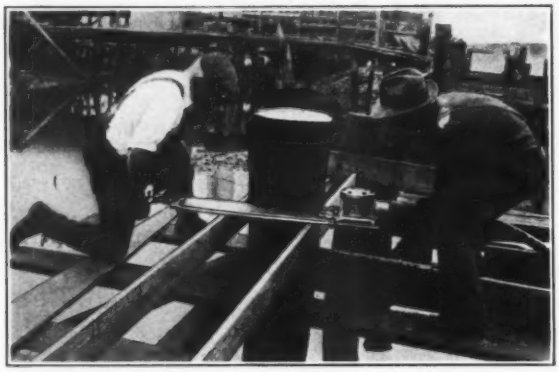

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STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACTS OF CONGRESS OF AUGUST 24, 1912, AND MARCH 3, 1933

Of Railway Engineering & Maintenance published monthly at Chicago, Ill., for Oct. 1, 1941.

State of Illinois } ss.
County of Cook }

Before me, a Notary Public in and for the State and county aforesaid, personally appeared Elmer T. Howson, who, having been duly sworn according to law, deposes and says that he is the editor of the Railway Engineering and Maintenance and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business manager are: Publisher, Simmons-Boardman Publishing Corp., 105 West Adams St., Chicago, Ill.; Editor, Elmer T. Howson, 105 W. Adams St., Chicago, Ill.; Managing Editor, Neal D. Howard, 105 W. Adams St., Chicago, Ill.; Business Manager, F. C. Koch, 30 Church Street, New York, N.Y.

2. That the owners are: Simmons-Boardman Publishing Corporation, 30 Church Street, New York, N.Y.; Stockholders of 1 per cent or more of the total amount of stock are: I. B. Simmons, 15 Hillcrest Dr., Pelham Manor, N.Y.; P. A. Lee, Hopatcong, N.J.; Henry Lee, Hopatcong, N.J.; E. G. Wright, 398 N. Walnut Street, E. Orange, N.J.; S. O. Dunn, 105 West Adams Street, Chicago, Ill.; C. E. Dunn, 3500 Sheridan Blvd., Chicago, Ill.; L. B. Sherman, 575 Sheridan Road, Winnetka, Ill.; Mae E. Howson, 105 West Adams Street, Chicago, Ill.; B. L. Johnson, 6949 Bennett Avenue, Chicago, Ill.; Spencer Trask & Company, 25 Broad Street, New York, N.Y. General partners of Spencer Trask & Company are: Edwin M. Bulkley, Walnut Street, Englewood, N.J.; Acosta Nichols, Cold Spring Road, Oyster Bay, N.Y.; Cecil Barret, Carlyle Hotel, New York, N.Y.; C. Everett Bacon, 16 Erwin Park, Montclair, N.J.; P. Malbone Blodget, 65 Patterson Ave., Greenwich, Conn.; Arthur H. Gilbert, 440 Park Ave., New York, N.Y.; Henry S. Allen, 407 Highland Ave., Orange, N.J.; William Kurt Beckers, Ridgefield Rd., Wilton, Conn.; Edwin M. Bulkley, Jr., 220 Madison Ave., New York, N.Y.; J. T. Foster, 66 Patterson Ave., Greenwich, Conn.

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ELMER T. HOWSON, Editor.

Sworn to and subscribed before me this 29th day of September, 1941.

(SEAL) ANNE A. BOYD.

(My commission expires Dec. 10, 1943.)

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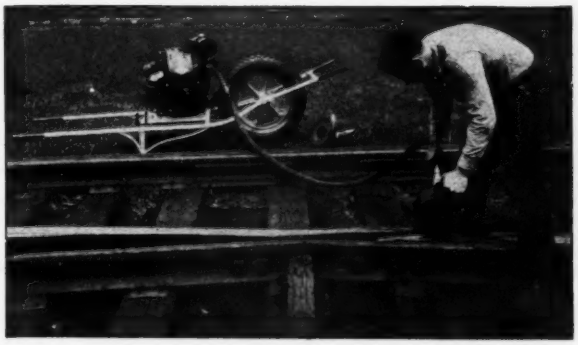
● It's fine to "Keep 'Em Rolling" but to do so with speed AND safety your track has to be good. That's a defense job for Railway Track-work Track Grinders —guarding rail against progressive deterioration due to battered ends, worn points, corrugations.

R-T Track Grinders, product of a plant making nothing else, have proved themselves on leading roads. For descriptions of the wide line of many models, ask for latest Data Bulletins.



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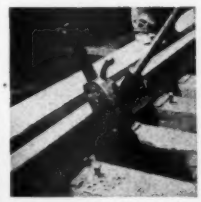

For track laying and maintenance on bridges use the No. 310 — it fits between the ties. Lifts on toe for surfacing and tilts on its base for lining operations. A 5-ft. chain supplied, any link of which engages in recess in cap, has grab-hook at one end and bridge bolt puller at other. The "310" lifts full 15-tons on both cap and toe.

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JACKSON ELECTRIC TAMPER & EQUIPMENT CO.
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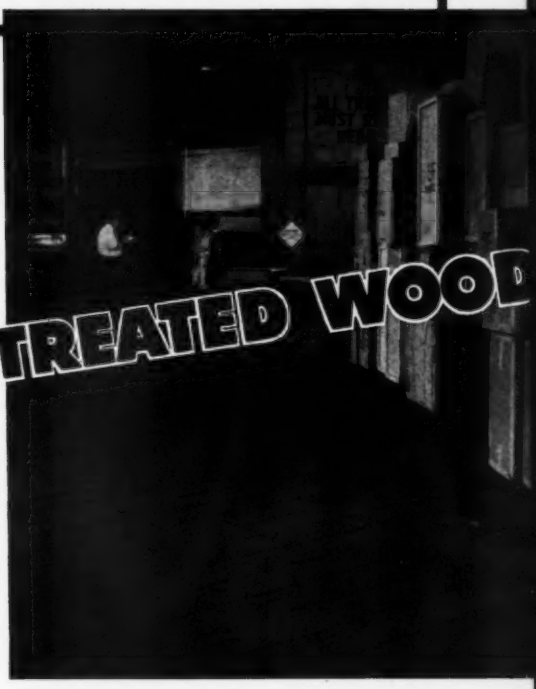

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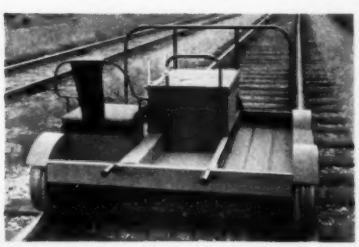

Also If you need a larger, heavier motor car that will carry up to four men, investigate the Buda "Roadmaster". (Model F-2 Roadmaster or small gang car, illustrated above.)

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